Report on Test Measurements

Measurements Report
The measurement report shows compliance information against the pertinent technical standards. Each parameter is measured generally at the low end, middle, and at the high end of the applicable frequency band. Each section of the report contains either verbiage or graphs which show compliance to applicable standards as required, explains testing method used, and indicates what the applicable specification is.
A list of test equipment for all sections, and certification signoff page are included at the end of the measurement report.

SUBMITTED MEASURED DATA -- INDEX

(Continued)

Report on Test Measurements

Measurements Report

SUBMITTED MEASURED DATA – INDEX (Continued)

EXHIBIT DESCRIPTION

Report on Test Measurements

RF Power Output Data

The RF power output was measured with the indicated voltage applied to and current into the final RF amplifying device(s). The DC current indicated is the total for the final RF amplifier stage.

Linear Simulcast Modulation Mode:

	851 MHz	860 MHz	869 MHz	
Measured RF output	**33**	**33**	**33**	Watts
DC Voltage, final RF amplifier stage/stages	**25.5**	**25.5**	**25.5**	Volts
DC Current, final RF amplifier stage/stages	**4.5**	**4.5**	**4.6**	Amperes
Input power for final RF amplifying device(s)	**115**	**116**	**117**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC
Minimum Measured RF output	**2**	**2**	**2**	Watts
DC Voltage, final RF amplifier stage/stages	**19**	**19**	**19**	Volts
Normal DC Current	**1.5**	**1.6**	**1.6**	Amperes
Input power for final RF amplifying device(s)	**29**	**29**	**30**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC

Frequency Modulation and Compatible 4-Level Frequency Modulation Mode:

	851 MHz	860 MHz	869 MHz	
Measured RF output	**33**	**33**	**33**	Watts
DC Voltage, final RF amplifier stage/stages	**25.5**	**25.5**	**25.5**	Volts
DC Current, final RF amplifier stage/stages	**4.9**	**5.0**	**5.0**	Amperes
Input power for final RF amplifying device(s)	**126**	**126**	**127**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC
Minimum Measured RF output	**2**	**2**	**2**	Watts
DC Voltage, final RF amplifier stage/stages	**19**	**19**	**19**	Volts
Normal DC Current	**1.6**	**1.6**	**1.6**	Amperes
Input power for final RF amplifying device(s)	**30**	**30**	**30**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC

Report on Test Measurements

Occupied Bandwidth **–** *Linear Simulcast Modulation (LSM), 12.5 kHz Channel Spacing*
Linear Simulcast Modulation can be used in a system configuration based upon channel usage as described in Exhibit B. The 'D1E' emission designator provides usage for telephony, the 'D1D' provides usage for data / telecommand, and the 'D1W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type:	Linear Simulcast Modulation, LSM
Emission Designator:	8K70D1E, 8K70D1D, 8K70D1W
Channelization:	12.5 kHz
Power Setting:	33 Watts, Average

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth (f_0) to 5.625 kHz removed from f_0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to ensure that the emission profile is developed.

Necessary Bandwidth Calculation: The necessary bandwidth of the modulation signal is not directly calculable per the composite modulation formulas defined in 47 CFR §2.202(g) / TRC-43 section 8. Quadrature Phase Shift Keying is used to modulate a carrier with a digital bit stream: Data Rate: R = 9600 bps; Bits per Symbol: S=4; Bn = 2BK; B = R/log2(s) = 9600/log2(4) = 4800; K= 0.9; Bn = 2*4800*0.9; Bn = 8700 Hz. The necessary bandwidth of 8.70 kHz is based upon a 99% power measurement of the transmitter spectrum, per §2.202(a) / TRC-43 section 7(c).

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz
Detector:	Peak		

Measured Occupied Bandwidth	
Resolution BW:	150 Hz
Span:	15 kHz
Number of Points:	1601
Integration Time:	14.8 ms

Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Use the analyzer controls to set this signal to the full-scale reference line. Allow the analyzer to sweep fully and store the sweep.
3) Use the band power marker function of the spectrum analyzer to measure the power of the carrier.
4) Use the carrier power value from the previous step to generate the emission mask limit.
5) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

Report on Test Measurements

EXHIBIT	DESCRIPTION	Meas Occ BW
E1-2.1	Occupied Bandwidth - Linear Simulcast Modulation (LSM), Low End of Band	8.89 kHz
E1-2.2	Occupied Bandwidth - Linear Simulcast Modulation (LSM), Middle of Band	8.92 kHz
E1-2.3	Occupied Bandwidth - Linear Simulcast Modulation (LSM), High End of Band	8.97 kHz

Report on Test Measurements

Occupied Bandwidth – Compatible 4-Level Frequency Modulation (C4FM), 12.5 kHz Channel Spacing
C4FM can be used in a system configuration based upon channel usage as described in Exhibit B. The 'F1E' emission designator provides usage for telephony, the 'F1D' provides usage for data / telecommand, and the 'F1W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type: Compatible 4-Level Frequency Modulation, C4FM
Emission Designator: 8K10F1E, 8K10F1D, 8K10F1W
Channelization: 12.5 kHz
Power Setting: 33 Watts

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1)On any frequency from the center of the authorized bandwidth (f0) to 5.625 kHz removed from f0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(fd –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: *At least 50 plus 10 log10(P) dB or 70 dB, whichever is the lesser attenuation.*

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to ensure that the emission profile is developed.

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1)*	*Nec BW*
1.2 kHz	2.85 kHz	8.10 kHz	8K10

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			Measured Occupied Bandwidth
Horizontal:	12.5 kHz per Division	Resolution BW: 100 Hz	Resolution BW: 150 Hz
Vertical:	10 dB per Division	Video BW: 10 kHz	Span: 15 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span: 125 kHz	Number of Points: 1601
Detector:	Peak		Integration Time: 14.8 ms

Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Use the band power marker function of the spectrum analyzer to measure the power of the carrier.
4) Use the carrier power value from the previous step to generate the emission mask limit.
5) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

Report on Test Measurements

EXHIBIT	DESCRIPTION	Meas Occ BW
E1-2.4	Occupied Bandwidth - Compatible 4-Level Frequency Mod (C4FM), Low End of Band	7.83 kHz
E1-2.5	Occupied Bandwidth - Compatible 4-Level Frequency Mod (C4FM), Middle of Band	7.88 kHz
E1-2.6	Occupied Bandwidth - Compatible 4-Level Frequency Mod (C4FM), High End of Band	7.83 kHz

Report on Test Measurements

Occupied Bandwidth – Four-Level Frequency Modulation Widepulse Astro, 25 kHz Channel Spacing
Widepulse Astro is generally used in a simulcast system configuration based upon channel usage as described in Exhibit B. The 'F1E' emission designator provides usage for telephony, the 'F1D' provides usage for data / telecommand, and the 'F1W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type: Four-Level Frequency Modulation Widepulse Astro
Emission Designator: 10K0F1E, 10K0F1D, 10K0F1W
Channelization: 2 5 kHz
Power Setting: 33 Watts

Specification Requirement 47 CFR §90.210(c) and IC RSS-119 section 5.8.6 - Emission Limits – "G-Mask":
Emission *Mask G.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth:
At least 116 log (fd/6.1) dB, or 50 + 10 log (P) dB, or 70 dB (whichever is the lesser attenuation);

(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least 43 + 10 log (P) dB*.

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1)*	*Nec BW*
1.2 kHz	3.8 kHz	10.0 kHz	10K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			Measured Occupied Bandwidth
Horizontal:	12.5 kHz per Division	Resolution BW: 300 Hz	Resolution BW: 300 Hz
Vertical:	10 dB per Division	Video BW: 10 kHz	Span: 30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span: 125 kHz	Number of Points: 1601
Detector:	Peak		Integration Time: 7.4 ms

Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Use the band power marker function of the spectrum analyzer to measure the power of the carrier.
4) Use the carrier power value from the previous step to generate the emission mask limit.
5) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.7	Occupied Bandwidth - Four-Level Frequency Mod Widepulse Astro, Low End of Band	9.41 kHz
E1-2.8	Occupied Bandwidth - Four-Level Frequency Mod Widepulse Astro, Middle of Band	9.37 kHz
E1-2.9	Occupied Bandwidth - Four-Level Frequency Mod Widepulse Astro, High End of Band	9.33 kHz
E1-2.10	Occupied Bandwidth - Four-Level Frequency Mod Widepulse Astro, NPSPAC	9.25 kHz

Report on Test Measurements

Occupied Bandwidth –H-DQPSK, P25 Two Slot TDMA Digital Modulation, 12.5 kHz Channel Spacing
H-DQPSK modulation can be used in a system configuration based upon channel usage as described in Exhibit B. The 'D7E' emission designator provides usage for telephony, the 'D7D' provides usage for data / telecommand, and the 'D7W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type: H-DQPSK, P25 Two Slot TDMA Digital Modulation
Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W
Channelization: 12.5 kHz
Power Setting: 33 Watts, Average

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1)On any frequency from the center of the authorized bandwidth (f0) to 5.625 kHz removed from f0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(fd –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: *At least 50 plus 10 log10(P) dB or 70 dB, whichever is the lesser attenuation.*

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to ensure that the emission profile is developed.

Necessary Bandwidth Calculation: The necessary bandwidth of the modulation signal is not directly calculable per the composite modulation formulas defined in 47 CFR §2.202(g) / TRC-43 section 8. Quadrature Phase Shift Keying is used to modulate a carrier with a digital bit stream: Data Rate: R = 12000 bps; Bits per Symbol: S=4; Bn = 2BK; B = R/log2(s) = 12000/log2(4) = 6000; K= 0.81; Bn = 2*6000*0.81; Bn = 9800 Hz. The necessary bandwidth
of 9.80 kHz is based on a 99% power measurement of the transmitter spectrum, per §2.202(a) / TRC-43 section 7(c).

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			Measured Occupied Bandwidth
Horizontal:	12.5 kHz per Division	Resolution BW: 100 Hz	Resolution BW: 150 Hz
Vertical:	10 dB per Division	Video BW: 10 kHz	Span: 15 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span: 125 kHz	Number of Points: 1601
Detector:	Peak		Integration Time: 14.8 ms

Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Use the band power marker function of the spectrum analyzer to measure the power of the carrier.
4) Use the carrier power value from the previous step to generate the emission mask limit.
5) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

Report on Test Measurements

EXHIBIT	DESCRIPTION	Meas Occ BW
E1-2.11	Occupied Bandwidth - H-DQPSK P25 Two Slot TDMA Digital Mod, Low End of Band	9.75 kHz
E1-2.12	Occupied Bandwidth - H-DQPSK P25 Two Slot TDMA Digital Mod, Middle of Band	9.75 kHz
E1-2.13	Occupied Bandwidth - H-DQPSK P25 Two Slot TDMA Digital Mod, High End of Band	9.75 kHz

Report on Test Measurements

Occupied Bandwidth –3600 bps High Speed Trunking Control Data, 25 kHz Channel Spacing
There is one exhibit shown for 3600 bps high speed control data in 25 kHz channels. It can be used in a trunked system configuration based upon channel usage as described in Exhibit B. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type: Frequency Shift Keying Digital Modulation
Emission Designator: 16K0F1D
Channelization: 25 kHz
Power Setting: 33 Watts

Specification Requirement 47 CFR §90.210(c) and IC RSS-119 section 5.8.6 - Emission Limits – "G-Mask":
Emission *Mask G.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth:
At least 116 log (fd/6.1) dB, or 50 + 10 log (P) dB, or 70 dB (whichever is the lesser attenuation);

(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least 43 + 10 log (P) dB*.

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1.2 typ)*	*Nec BW*
1.8 kHz	5.0 kHz	15.6 kHz	16K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings Measured			Occupied Bandwidth
Horizontal:	12.5 kHz per Division	Resolution BW: 300 Hz	Resolution BW:300 Hz
Vertical:	10 dB per Division	Video BW: 10 kHz	Span: 30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span: 125 kHz	Number of Points: 1601
Detector:	Peak		Integration Time: 7.4 ms

Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Use the carrier power value from the previous step to generate the emission mask limit.
4) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.14	Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels, Low End of Band	7.92 kHz
E1-2.15	Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels, Middle of Band	7.90 kHz
E1-2.16	Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels, High End of Band	7.96 kHz

Report on Test Measurements

Occupied Bandwidth –3600 bps High Speed Trunking Control Data, 12.5 kHz Channel Spacing
There is one exhibit shown for 3600 bps high speed control data in 12.5 kHz channels. It can be used in a trunked system configuration based upon channel usage as described in Exhibit B. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type: Frequency Shift Keying Digital Modulation
Emission Designator: 10K0F1D
Channelization: 12.5 kHz
Power Setting: 33 Watts

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1)On any frequency from the center of the authorized bandwidth (f0) to 5.625 kHz removed from f0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(fd –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: *At least 50 plus 10 log10(P) dB or 70 dB, whichever is the lesser attenuation.*

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to ensure that the emission profile is developed.

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1.2 typ)*	*Nec BW*
1.8 kHz	2.5 kHz	9.6 kHz	10K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings		Measured Occupied Bandwidth
Horizontal: 12.5 kHz per Division	Resolution BW: 100 Hz	Resolution BW: 150 Hz
Vertical: 10 dB per Division	Video BW: 10 kHz	Span: 15 kHz
Sweep Time: 72 Seconds (<2 kHz/Sec)	Span: 125 kHz	Number of Points: 1601
Detector: Peak		Integration Time: 14.8 ms

Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Use the carrier power value from the previous step to generate the emission mask limit.
4) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.17	Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels, Low End of Band	5.41 kHz
E1-2.18	Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels, Middle of Band	5.39 kHz
E1-2.19	Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels, High End of Band	5.40 kHz

Report on Test Measurements

Occupied Bandwidth –3600 bps High Speed Trunking Control Data, NPSPAC Channels
There is one exhibit shown for 3600 bps high speed control data for channels in the FCC public safety band. It can be used in a trunked system configuration based upon channel usage as described in Exhibit B. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type: Frequency Shift Keying Digital Modulation
Emission Designator: 14K0F1D
Channelization: 25 kHz
Power Setting: 33 Watts

Specification Requirement § 90.210(d) Emission Limits – "H-Mask":
Emission *Mask H.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of 4 kHz or less: Zero dB
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 4 kHz but no more than 8.5 kHz: *At least 107 * $\log_{10}(f_d / 4)$ dB*
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 8.5 kHz, but no more than 15 kHz: *At least 40.5 $\log_{10}(f_d / 1.16)$ dB;*
(4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 15 kHz, but no more than 25 kHz: *At least 116 $\log_{10}(f_d / 6.1)$ dB;*
(5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: *At least 43 plus 10 $\log_{10}(P)$ dB*

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR 2.202 (b) is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1.2 typ)*	*Nec BW*
1.8 kHz	4.0 kHz	13.2 kHz	14K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			Measured Occupied Bandwidth
Horizontal:	12.5 kHz per Division	Resolution BW: 300 Hz	Resolution BW: 300 Hz
Vertical:	10 dB per Division	Video BW: 10 kHz	Span: 30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span: 125 kHz	Number of Points: 1601
Detector:	Peak		Integration Time: 7.4 ms

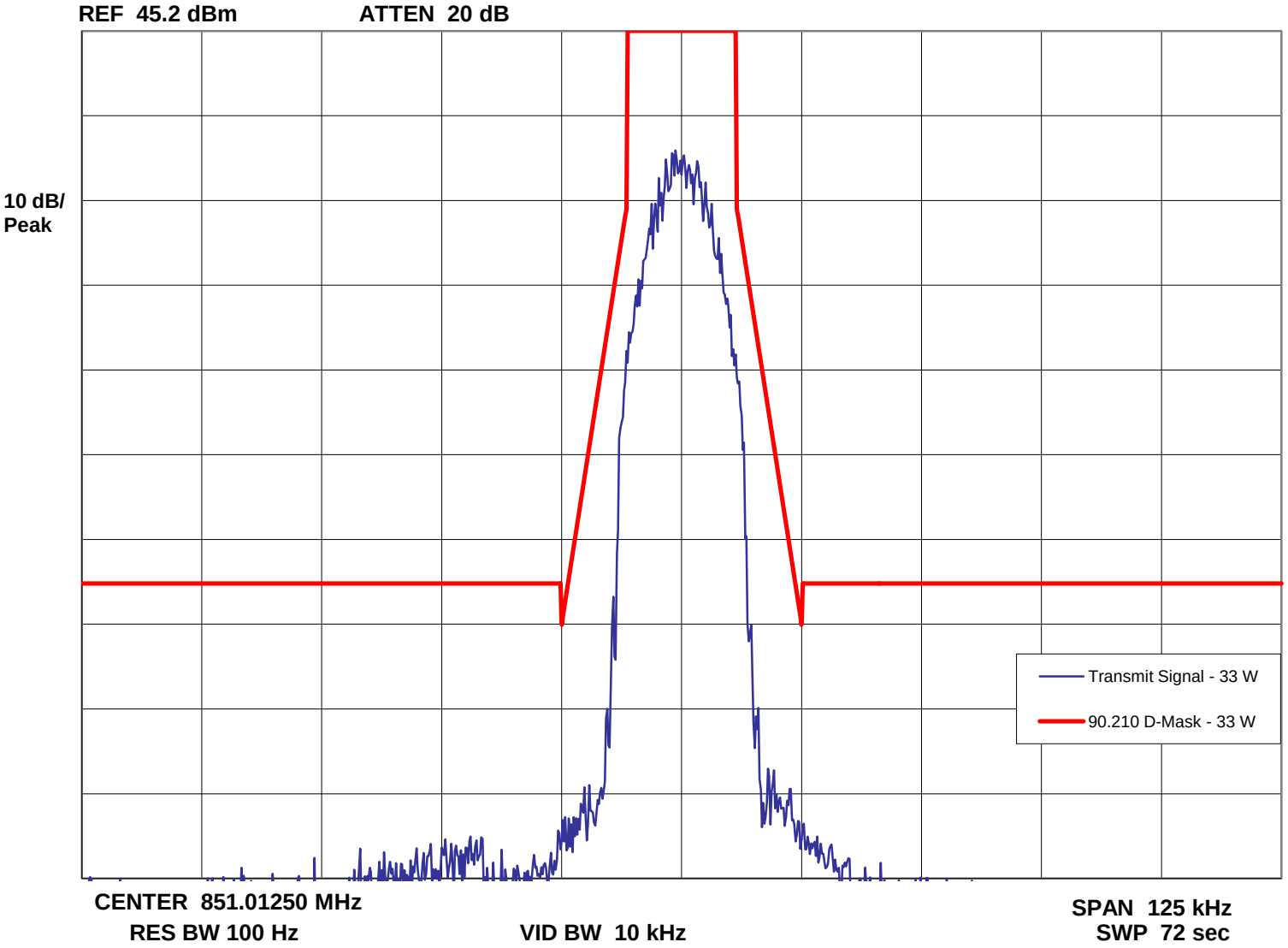
Test Procedure:
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Use the carrier power value from the previous step to generate the emission mask limit.
4) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.20	Trunking Control Data 3600 bps FSK Modulation, NPSPAC Channels	10.93 kHz

Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM) – Emission Designator: 8K70D1E, 8K70D1D, 8K70D1W – Low End of Band

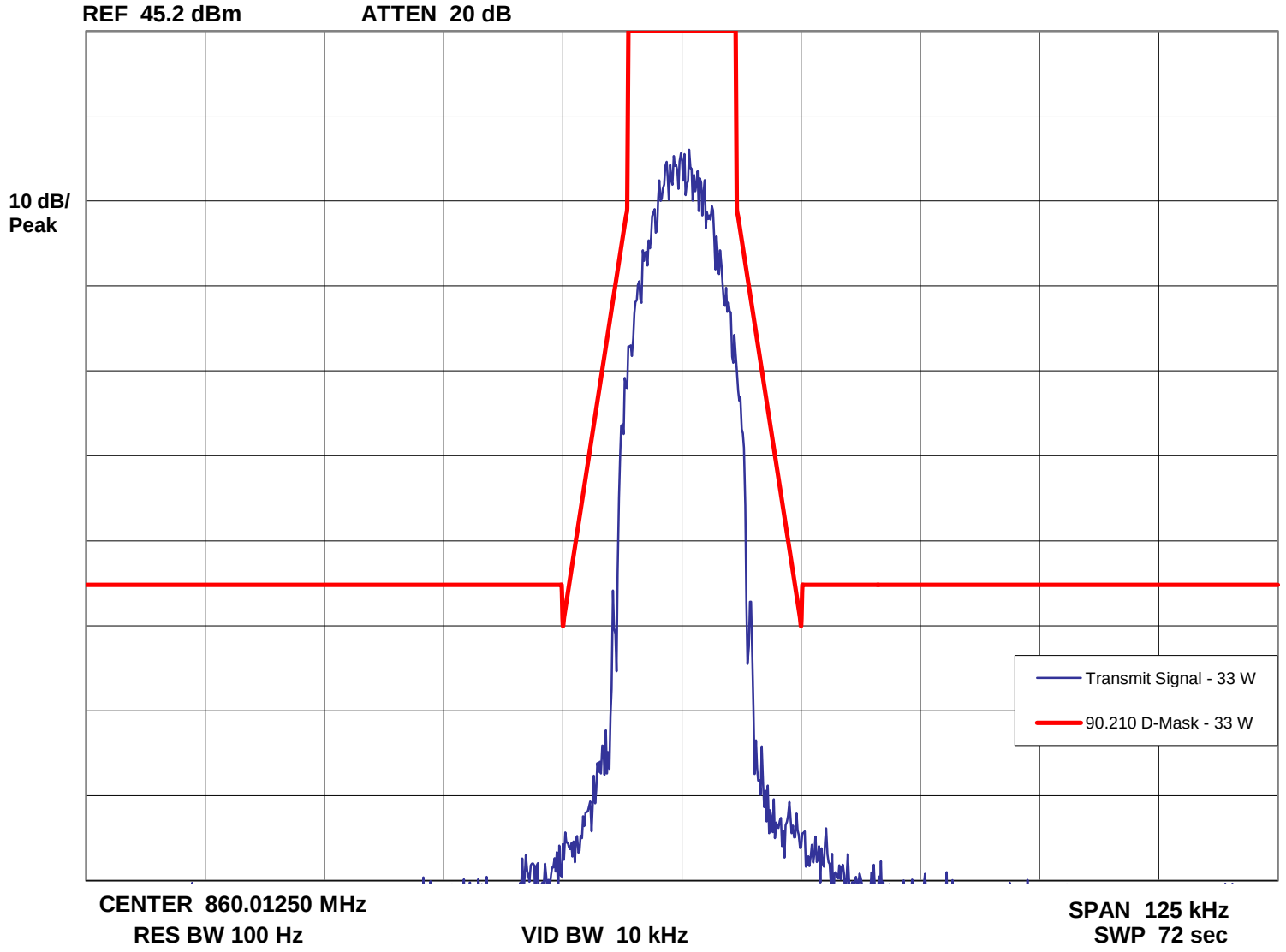
Occupied Bandwidth -- Linear Simulcast Modulation - 33 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM) – Emission Designator: 8K70D1E, 8K70D1D, 8K70D1W – Middle of Band

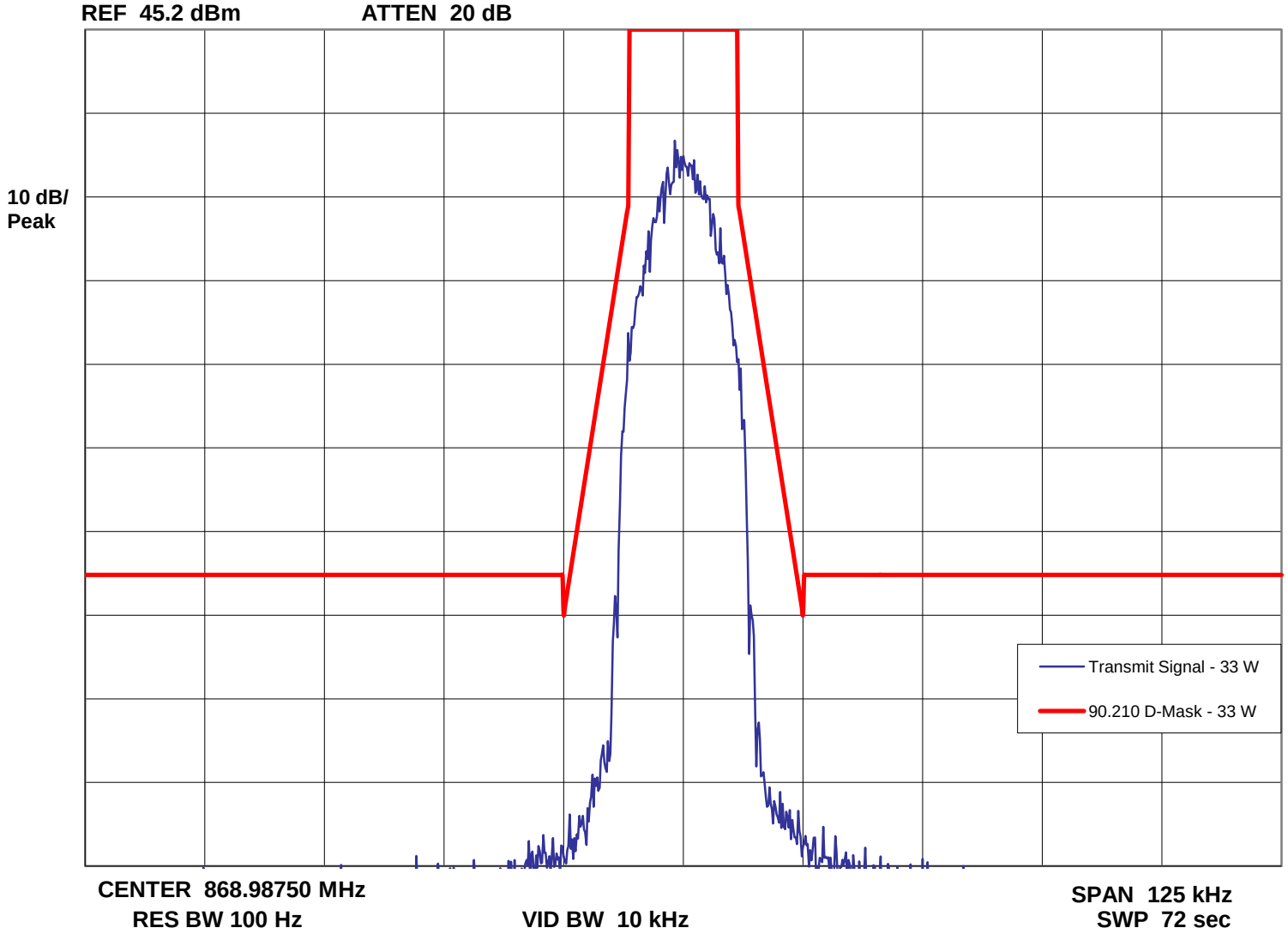
Occupied Bandwidth -- Linear Simulcast Modulation - 33 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM) – Emission Designator: 8K70D1E, 8K70D1D, 8K70D1W – High End of Band

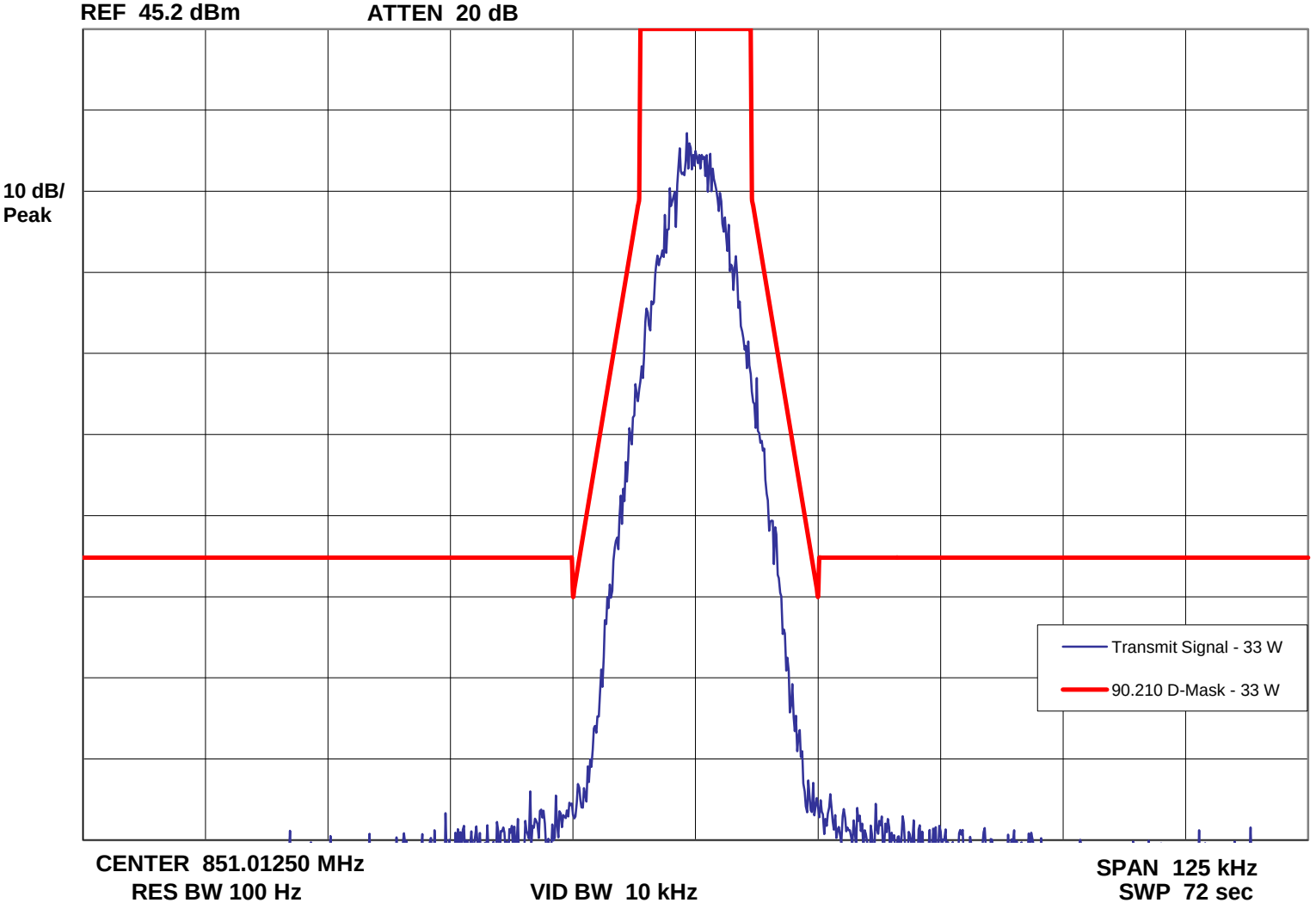
Occupied Bandwidth -- Linear Simulcast Modulation - 33 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Linear Compatible 4-Level Frequency Modulation (C4FM) – Emission Designator: 8K10D1E, 8K10D1D, 8K10D1W, Low End of Band

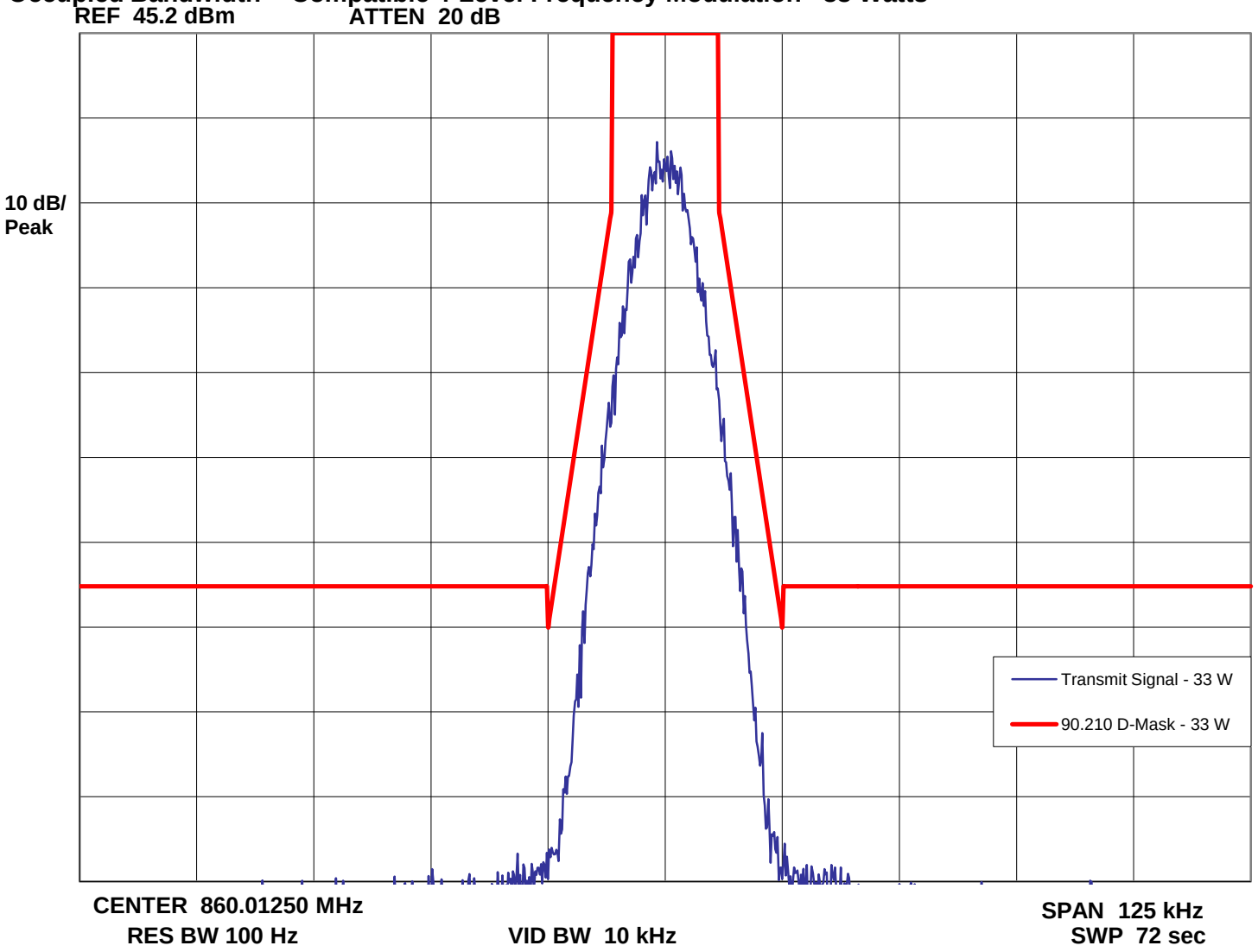
Occupied Bandwidth -- Compatible 4-Level Frequency Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Linear Compatible 4-Level Frequency Modulation (C4FM) – Emission Designator: 8K10D1E, 8K10D1D, 8K10D1W, Middle of Band

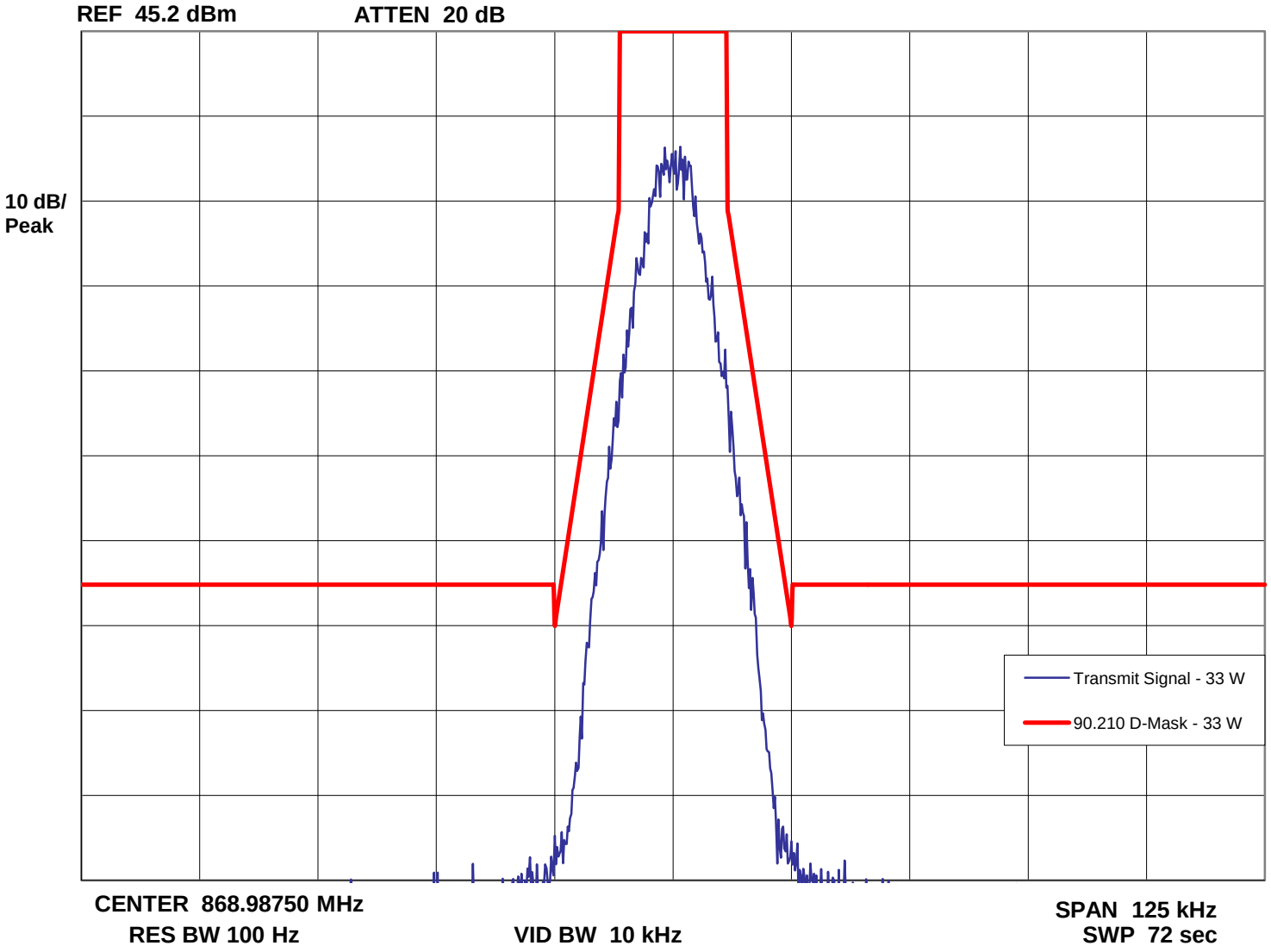
Occupied Bandwidth -- Compatible 4-Level Frequency Modulation - 33 Watts



Report on Test Measurements

Compatible 4-Level Frequency Modulation (C4FM) – Emission Designator: 8K10D1E, 8K10D1D, 8K10D1W, High End of Band

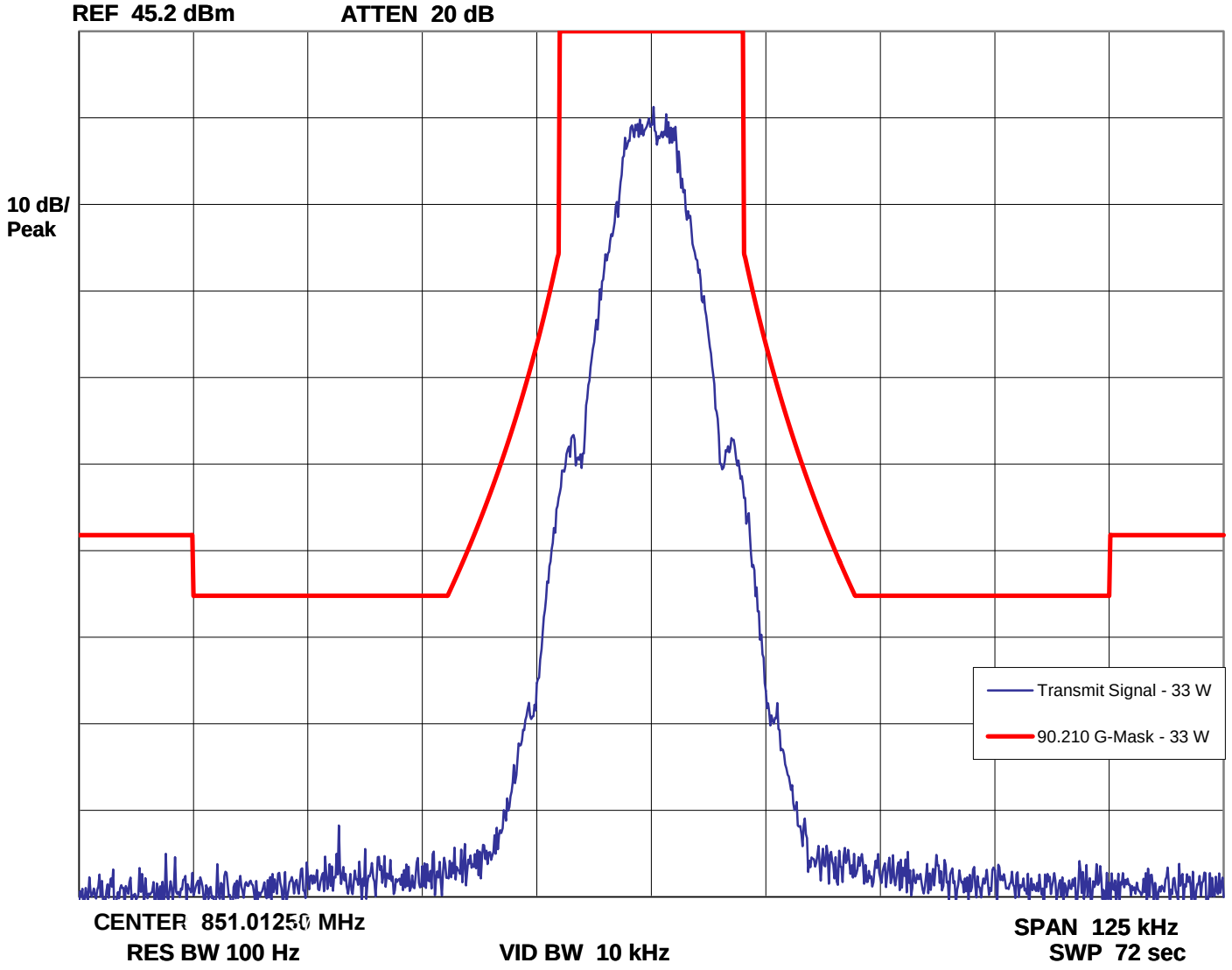
Occupied Bandwidth -- Compatible 4-Level Frequency Modulation - 33 Watts



Report on Test Measurements

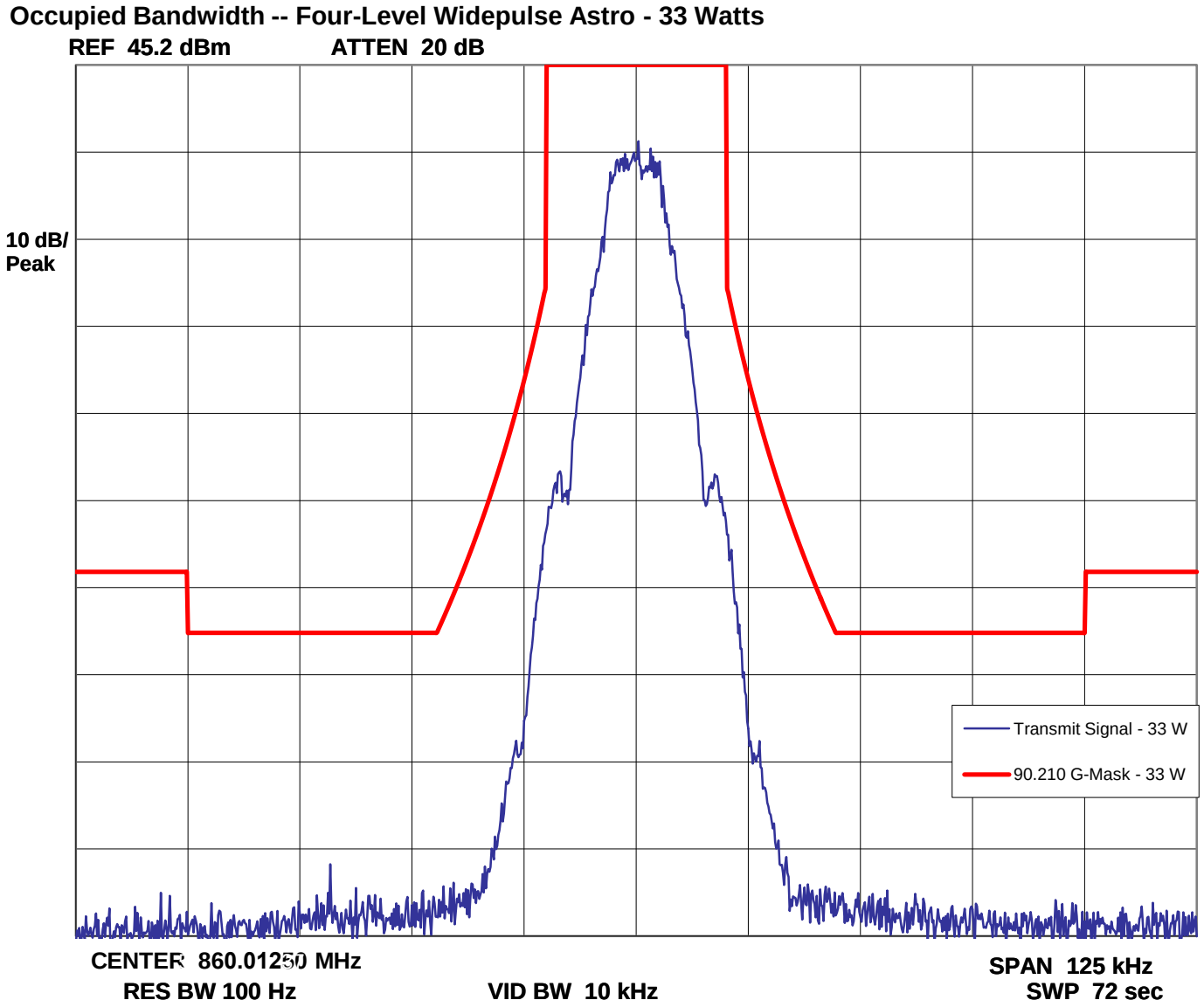
Occupied Bandwidth – Four-Level Frequency Modulation Widepulse Astro – Emission Designator: 10K0F1E, 10K0F1D, 10K0F1W, Low End of Band

Occupied Bandwidth -- Four-Level Widepulse Astro - 33 Watts



Report on Test Measurements

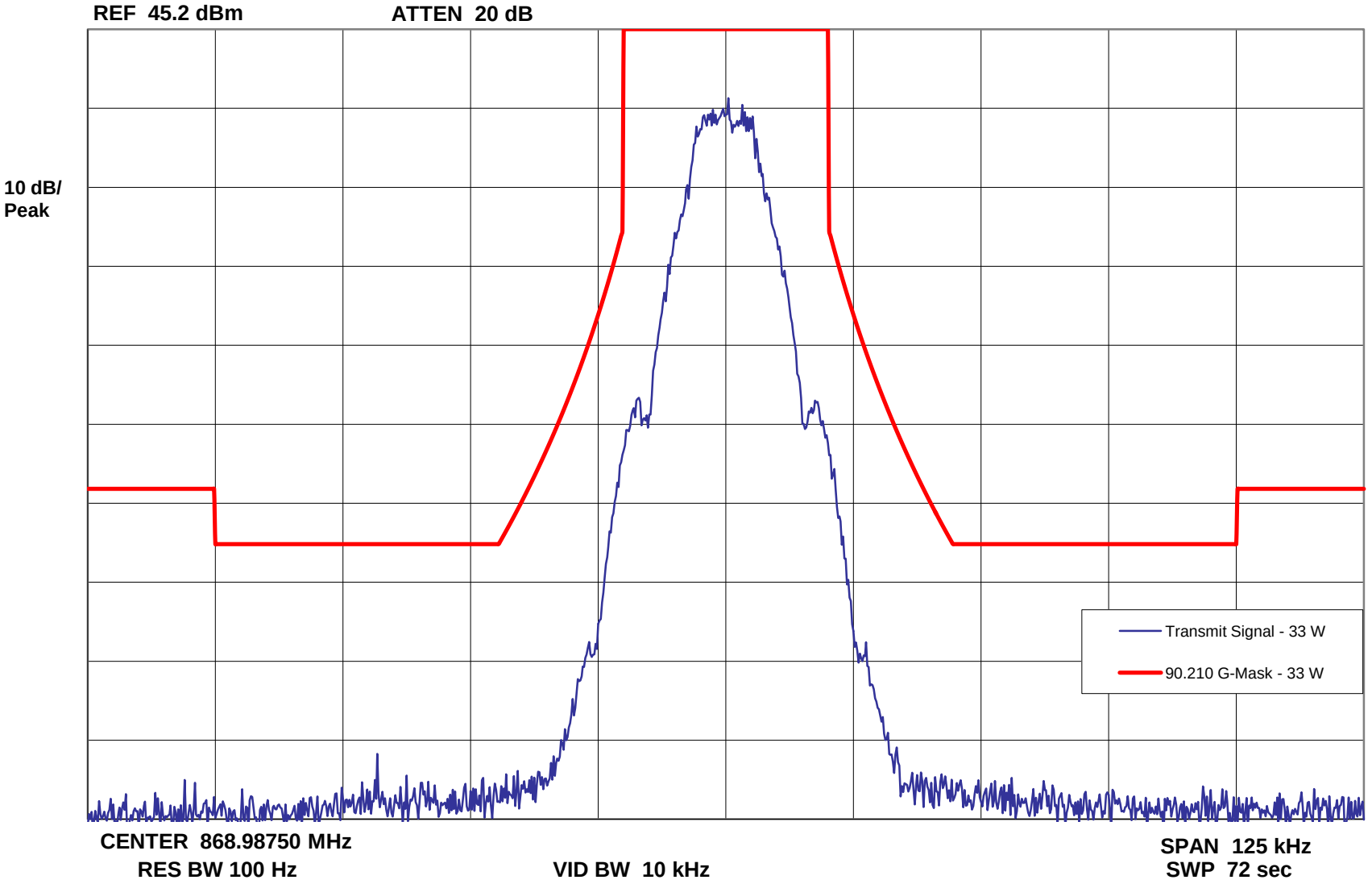
Occupied Bandwidth – Four-Level Frequency Modulation Widepulse Astro – Emission Designator: 10K0F1E, 10K0F1D, 10K0F1W, Middle of Band



Report on Test Measurements

Occupied Bandwidth – Four-Level Frequency Modulation Widepulse Astro – Emission Designator: 10K0F1E, 10K0F1D, 10K0F1W, High End of Band

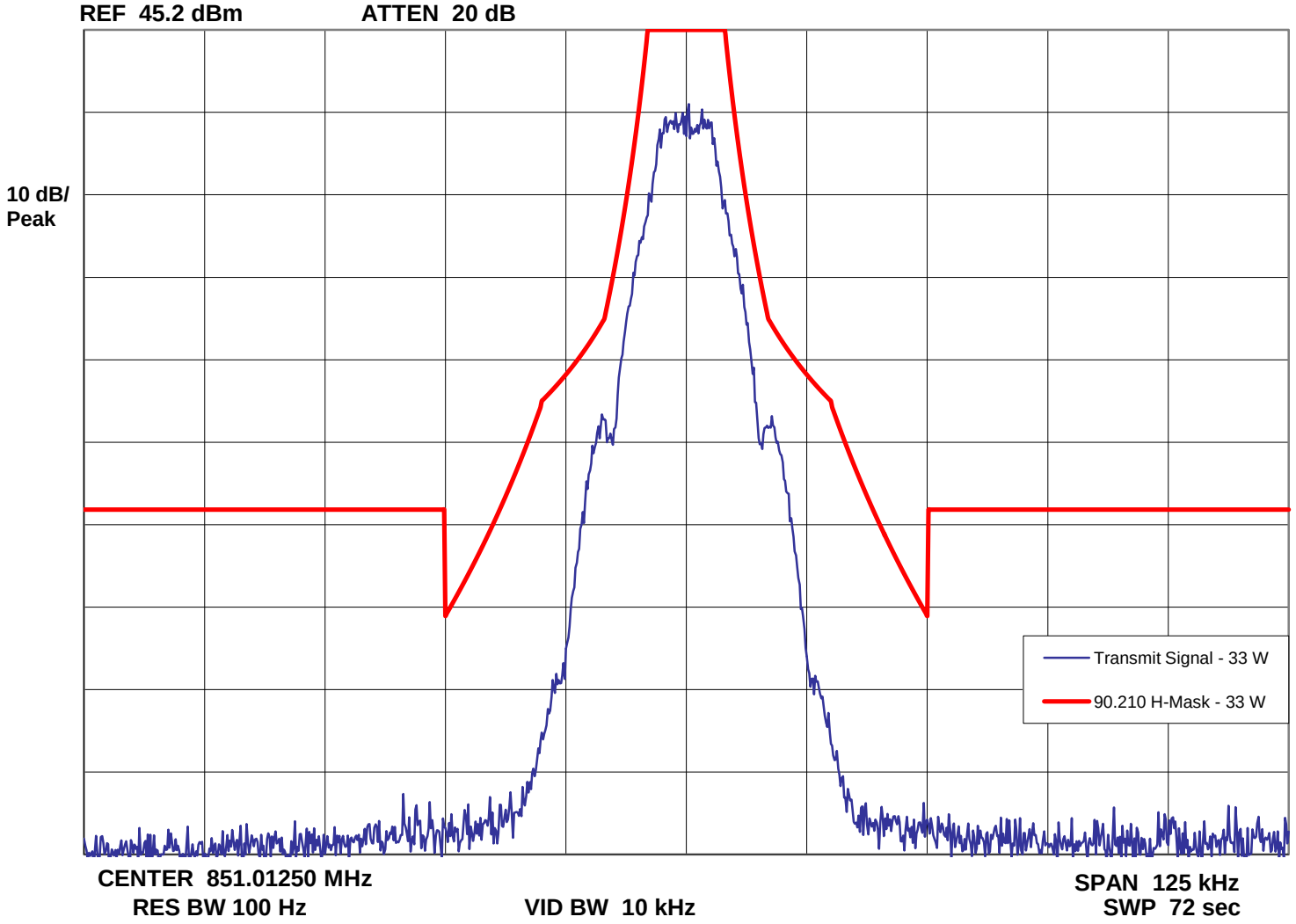
Occupied Bandwidth -- Four-Level Widepulse Astro - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Four-Level Frequency Modulation Widepulse Astro – Emission Designator: 10K0F1E, 10K0F1D, 10K0F1W, NPSPAC Band

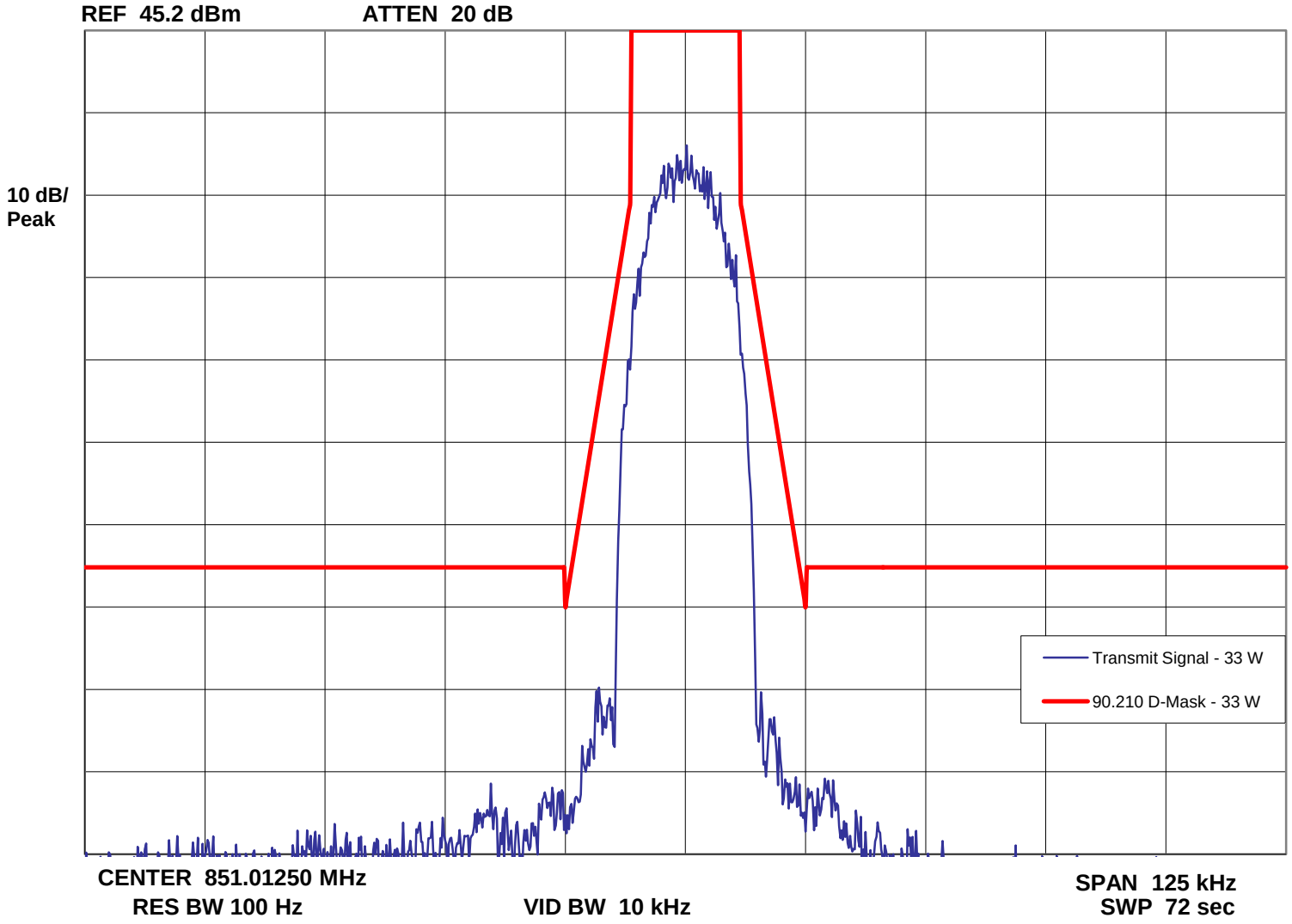
Occupied Bandwidth -- Four-Level Widepulse Astro - 33 Watts



Report on Test Measurements

Occupied Bandwidth – H-DQPSK, P25 Two Slot TDMA Digital Modulation – Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W, Low End of Band

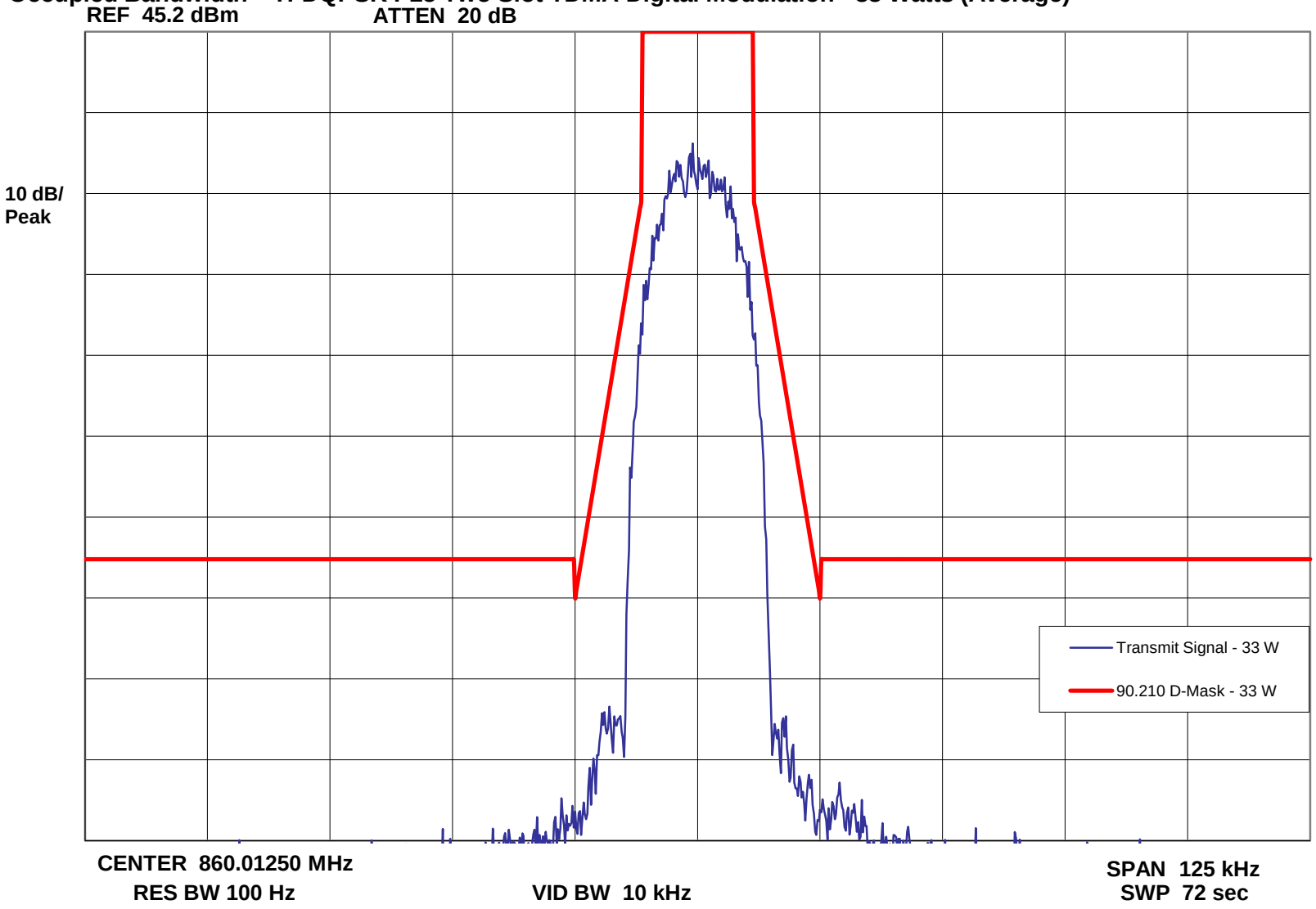
Occupied Bandwidth -- H-DQPSK P25 Two Slot TDMA Digital Modulation - 33 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Linear DQPSK, P25 Two Slot TDMA Digital Modulation – Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W, Middle of Band

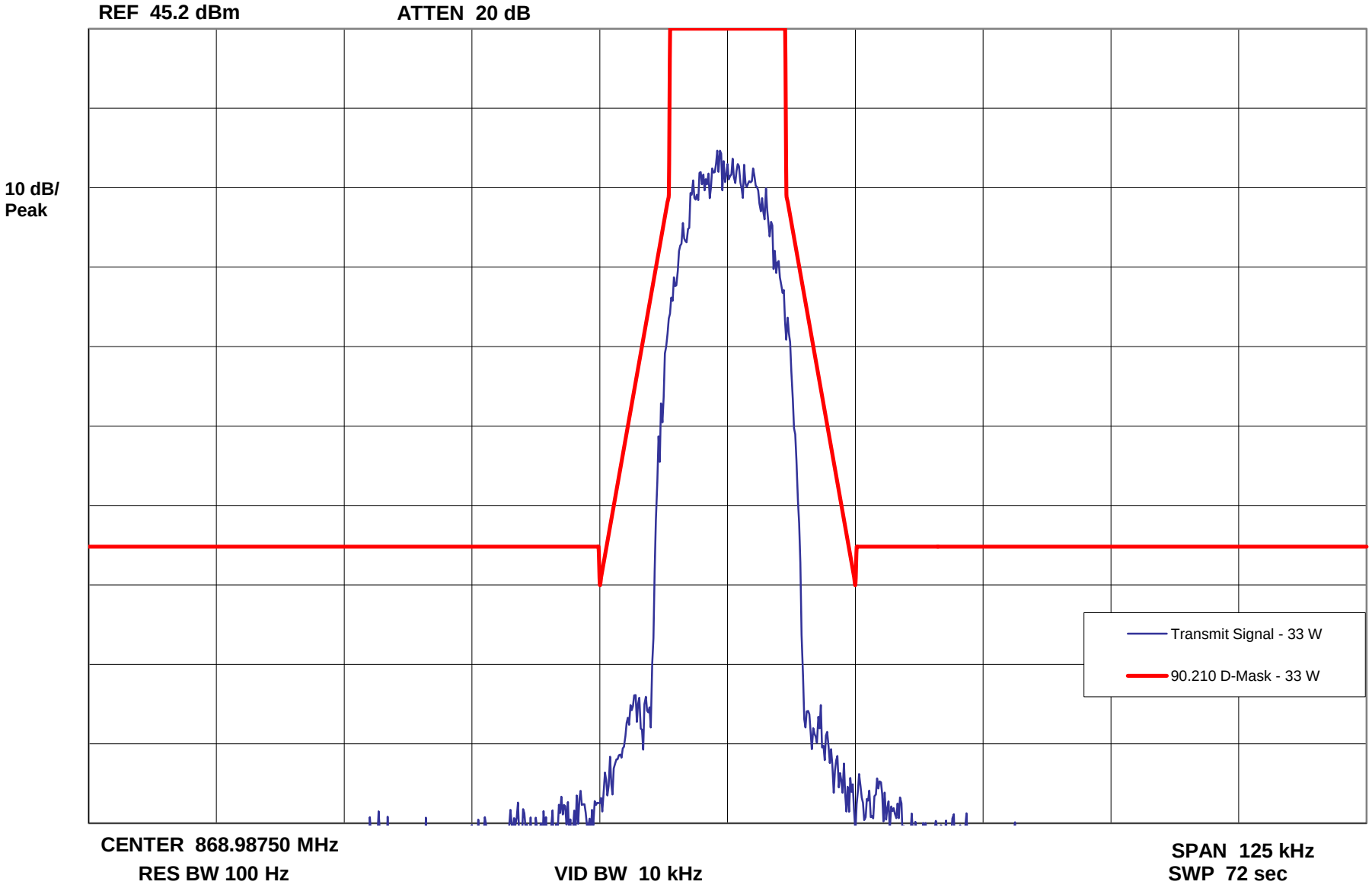
Occupied Bandwidth -- H-DQPSK P25 Two Slot TDMA Digital Modulation - 33 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Linear DQPSK, P25 Two Slot TDMA Digital Modulation – Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W, High End of Band

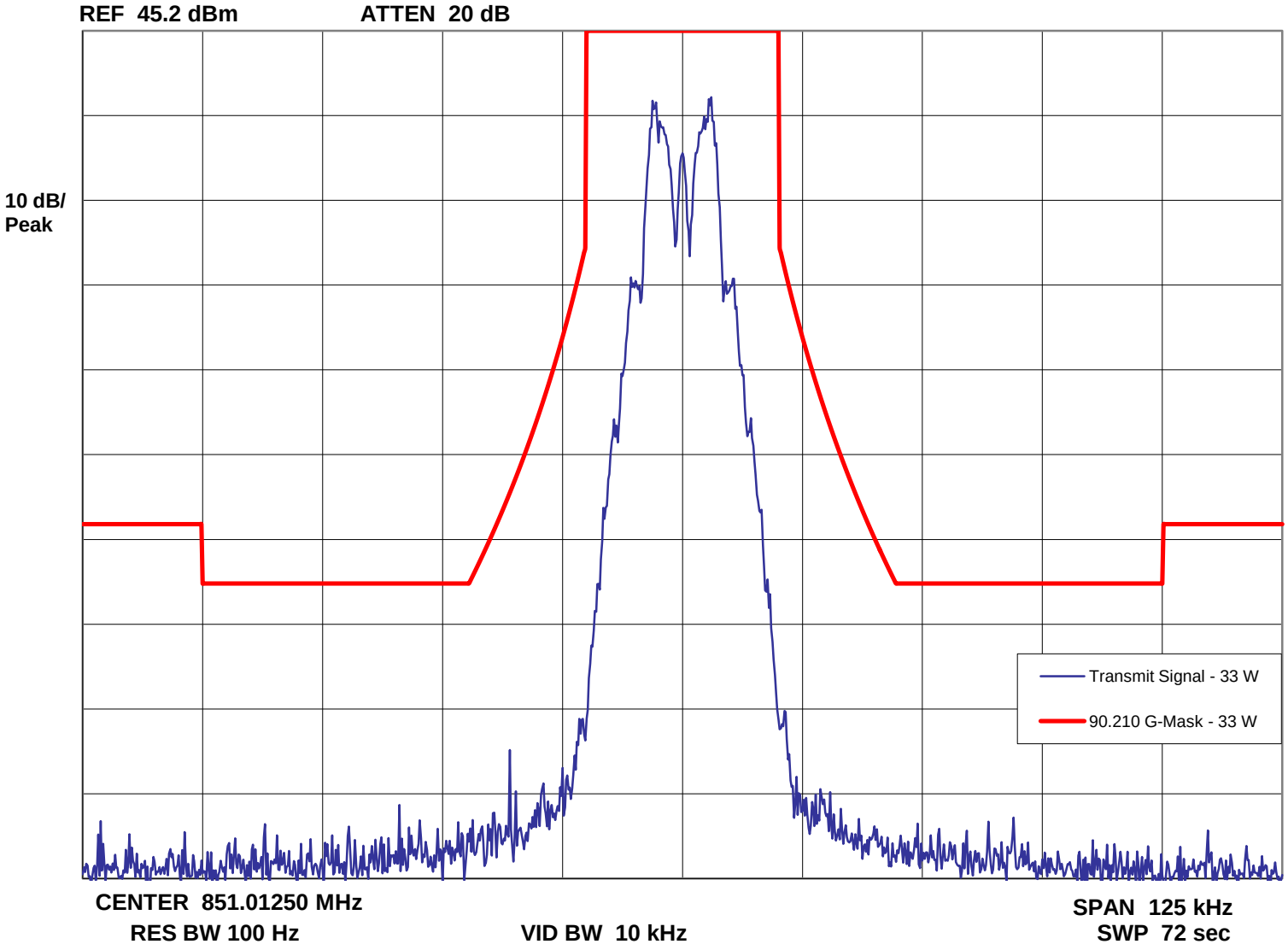
Occupied Bandwidth -- H-DQPSK P25 Two Slot TDMA Digital Modulation - 33 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels – Emission Designator: 16K0F1D, Low End of Band

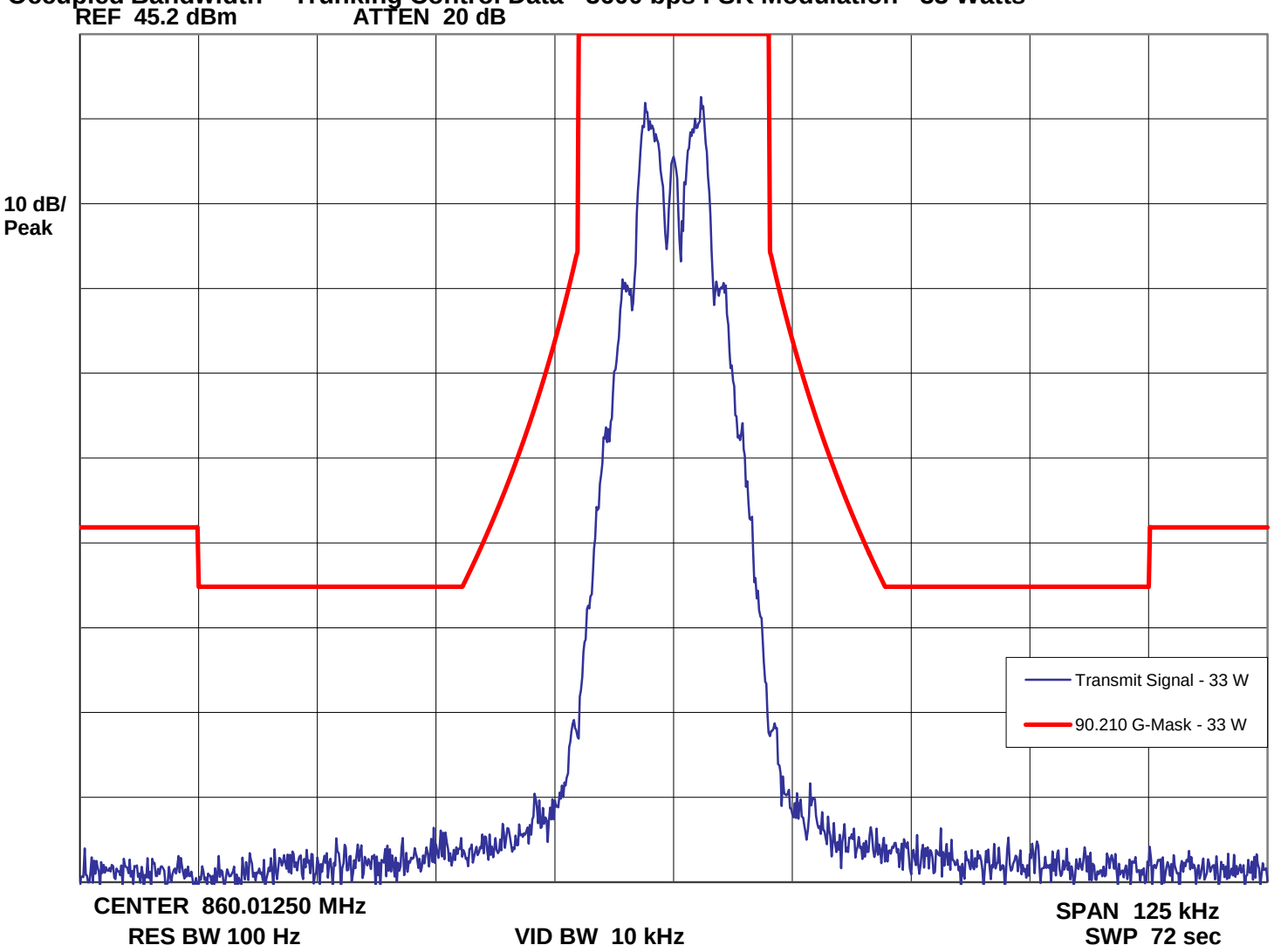
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels – Emission Designator: 16K0F1D, Middle of Band

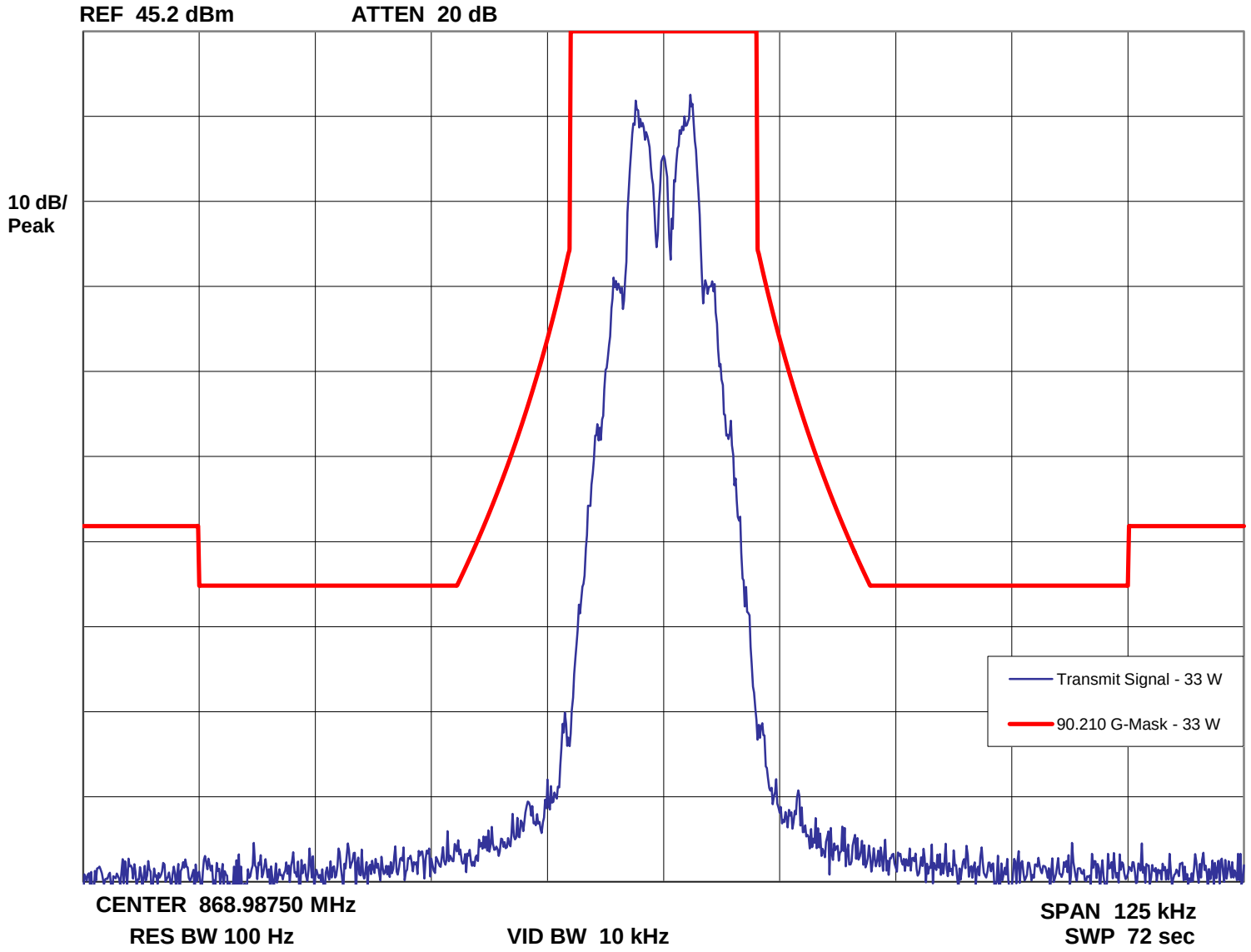
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Linear Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels – Emission Designator: 16K0F1D, High End of Band

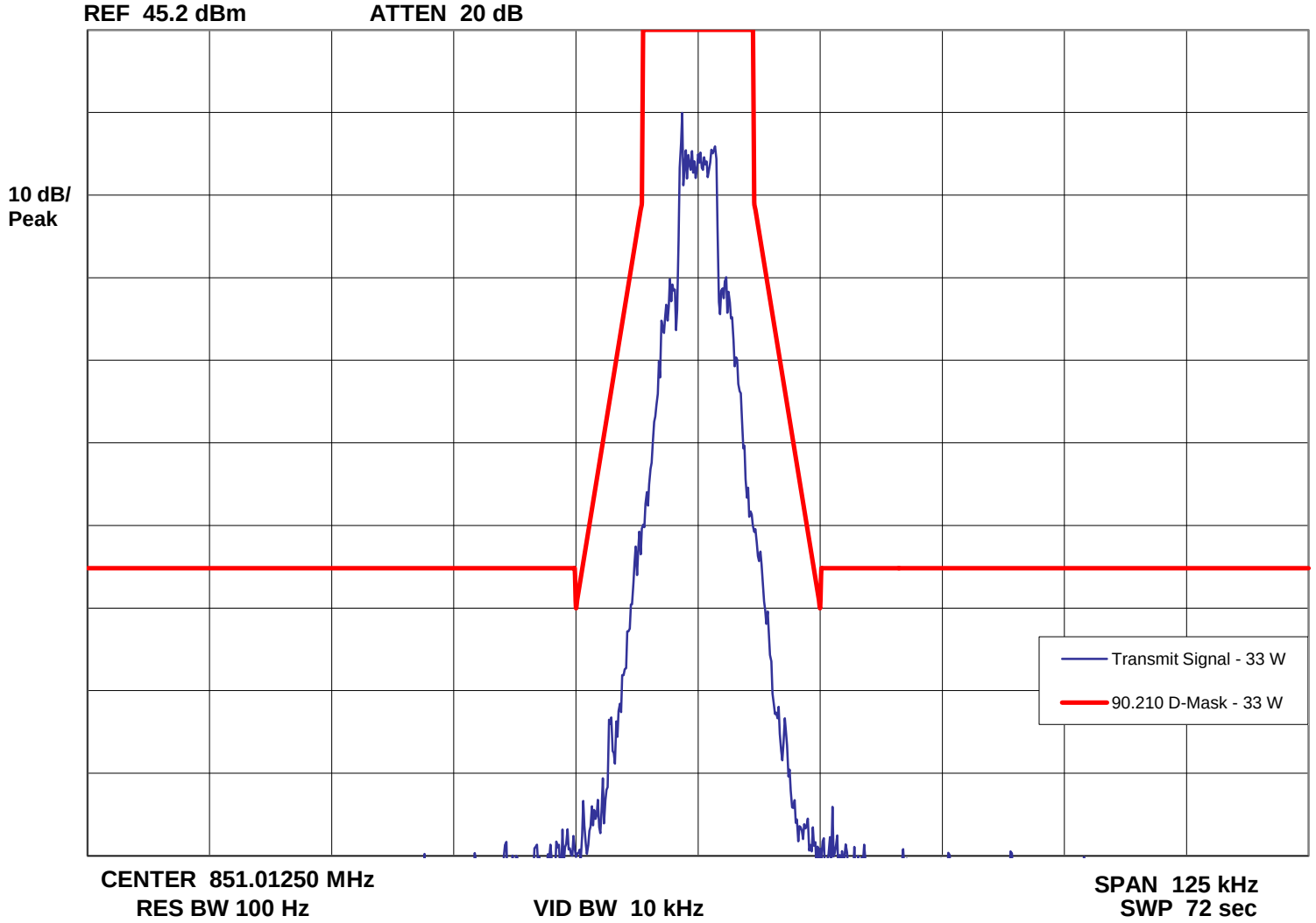
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels – Emission Designator: 10K0F1D, Low End of Band

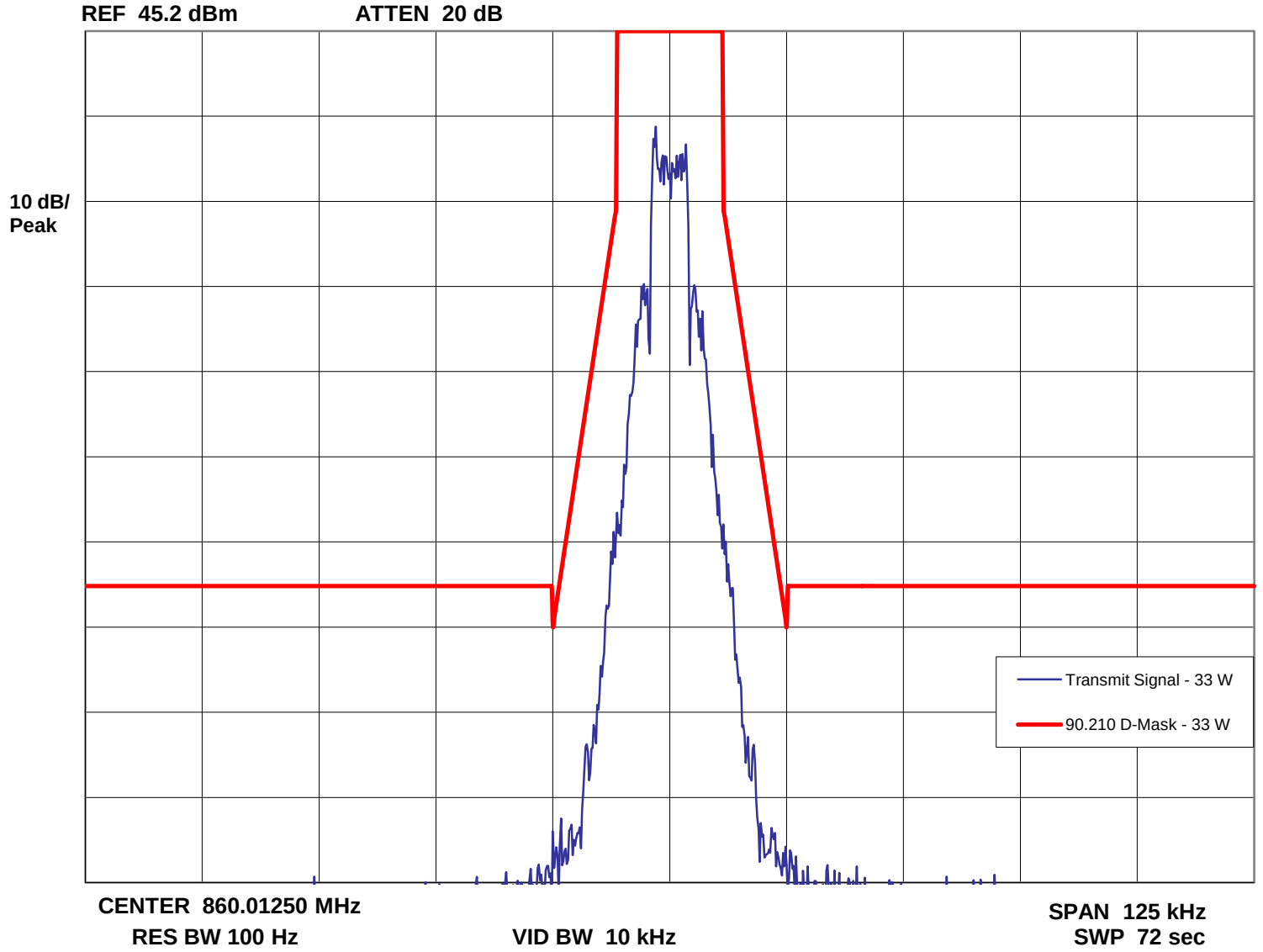
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels – Emission Designator: 10K0F1D, Middle of Band

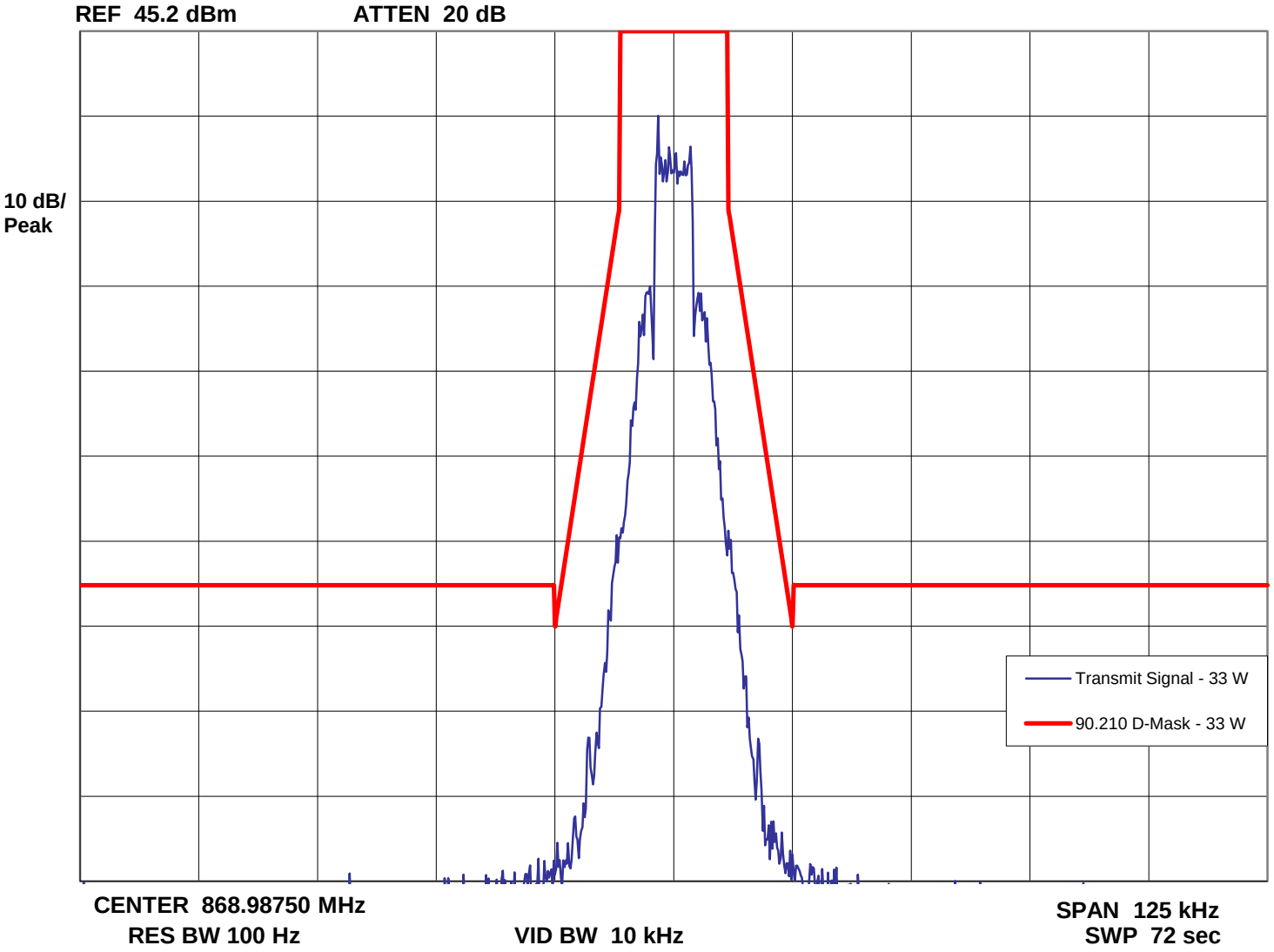
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Control Data 3600 bps FSK Modulation, 12.5 kHz Channels – Emission Designator: 10K0F1D, High End of Band

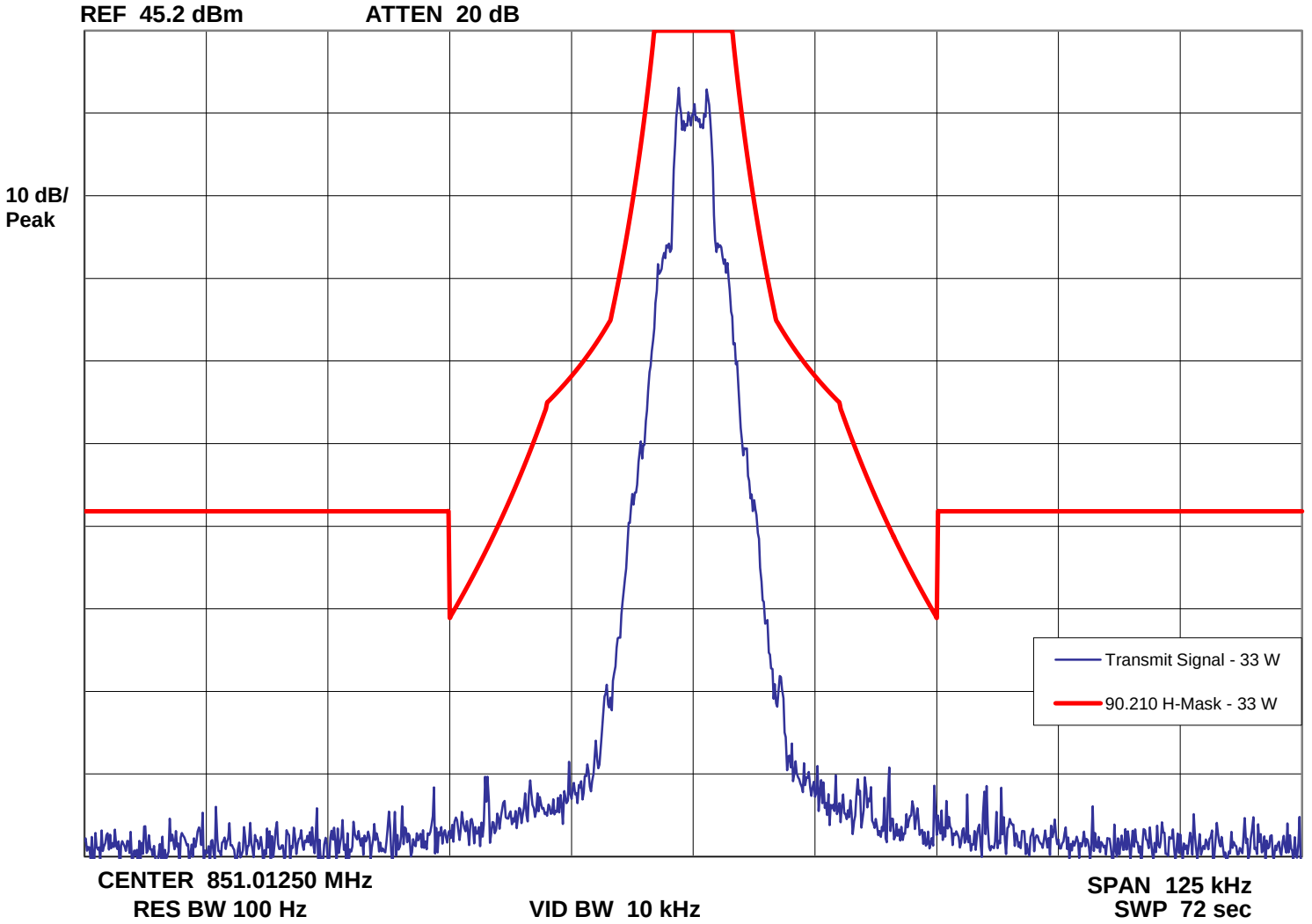
Occupied Bandwidth Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, NPSPAC Channels – Emission Designator: 14K0F1D

Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 33 Watts



Report on Test Measurements

Conducted Spurious Emissions – Harmonics and Emission Spectrum

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:
On any frequency removed from the assigned frequency by a displacement frequency (Fd in kHz) of:
c) >50 kHz *at least 43+10 * Log10 (P) dB.*

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D:* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: *At least 50 plus 10 log10(P) dB or 70 dB, whichever is the lesser attenuation.*

Specification Requirement § 90.210(g) and IC RSS-119 section 5.8.6 - Emission Limits – "G-Mask":
Emission *Mask G.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least 43 + 10 log (P) dB*.

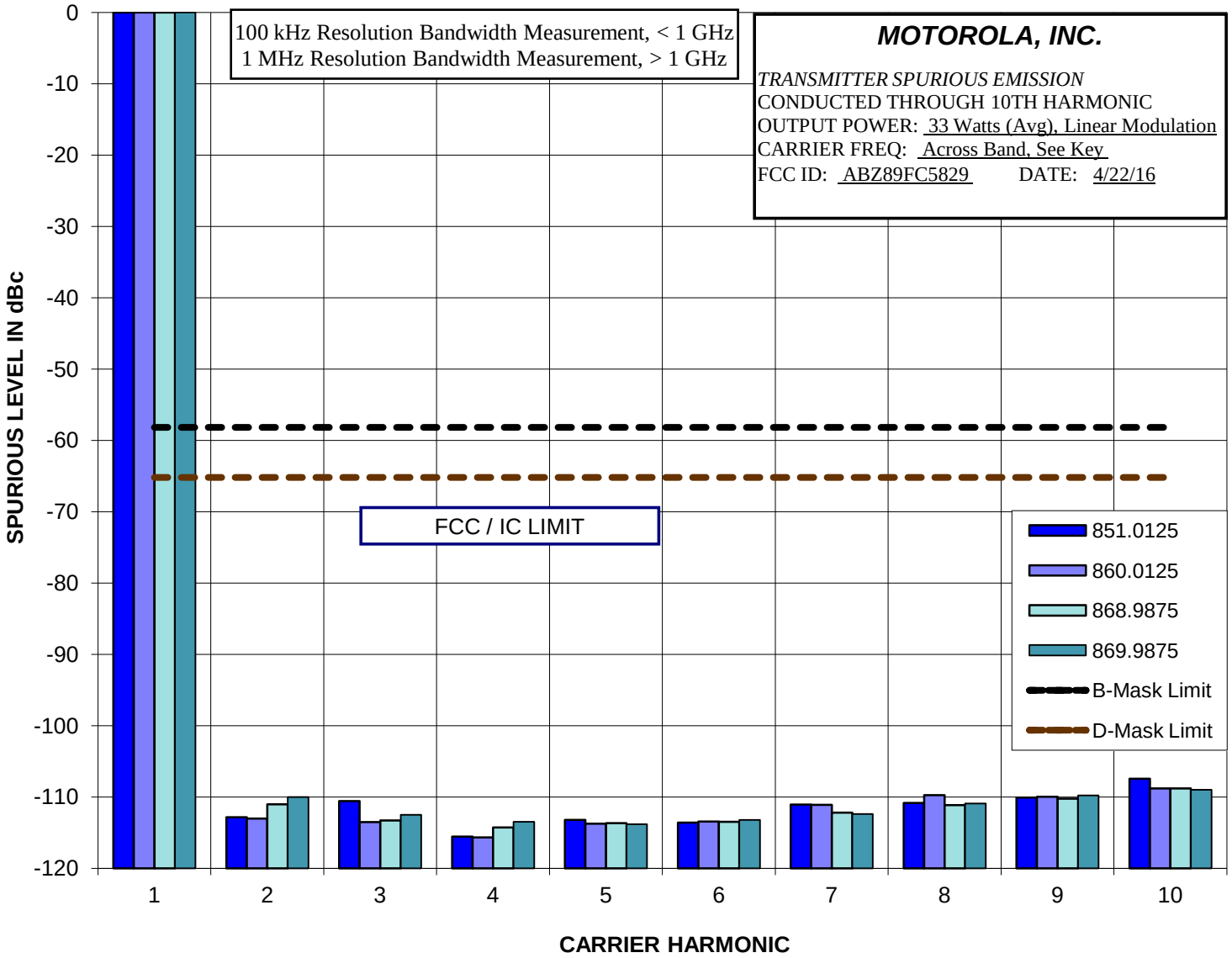
Modulation: Linear Simulcast Modulation (LSM), Compatible 4-Level Frequency Modulation (C4FM), or Analog Frequency Modulation as indicated

Carrier Frequencies: Carrier frequencies of 851.0125, 860.0125, and 868.9875 MHz were measured for conducted carrier harmonics and conducted emission. These frequencies represent the low end, center, and high end of the 851-870 MHz band, and are representative of the full operating band

EXHIBIT	DESCRIPTION
E1-3.1	Conducted Spurious Harmonic Emissions, Power Output 33 Watts (Average), LSM The specification limit is -65.2 dBc
E1-3.2	Conducted Spurious Harmonic Emissions, Power Output 2 Watts (Average), LSM The specification limit is -53.0 dBc
E1-3.3	Conducted Spurious Harmonic Emissions, Power Output 33 Watts, C4FM The specification limit is -65.2 dBc
E1-3.4	Conducted Spurious Harmonic Emissions, Power Output 2 Watts, C4FM The specification limit is -53.0 dBc
E1-3.5	Conducted Spurious Harmonic Emissions, Power Output 33 Watts, Analog The specification limit is -65.2 dBc
E1-3.6	Conducted Spurious Harmonic Emissions, Power Output 2 Watts, Analog The specification limit is -53.0 dBc
E1-3.7, 8, 9	Conducted Spurious Emission Spectrum, 200 MHz Span, Power Output at 33 Watts, LSM The specification limit is -65.2 dBc
E1-3.10, 11, 12	Conducted Spurious Emission Spectrum, 200 MHz Span, Power Output at 33 Watts, C4FM The specification limit is -65.2 dBc
E1-3.13, 14, 15	Conducted Spurious Emission Spectrum, MHz Span, Power Output at 33 Watts, Analog The specification limit is -65.2 dBc

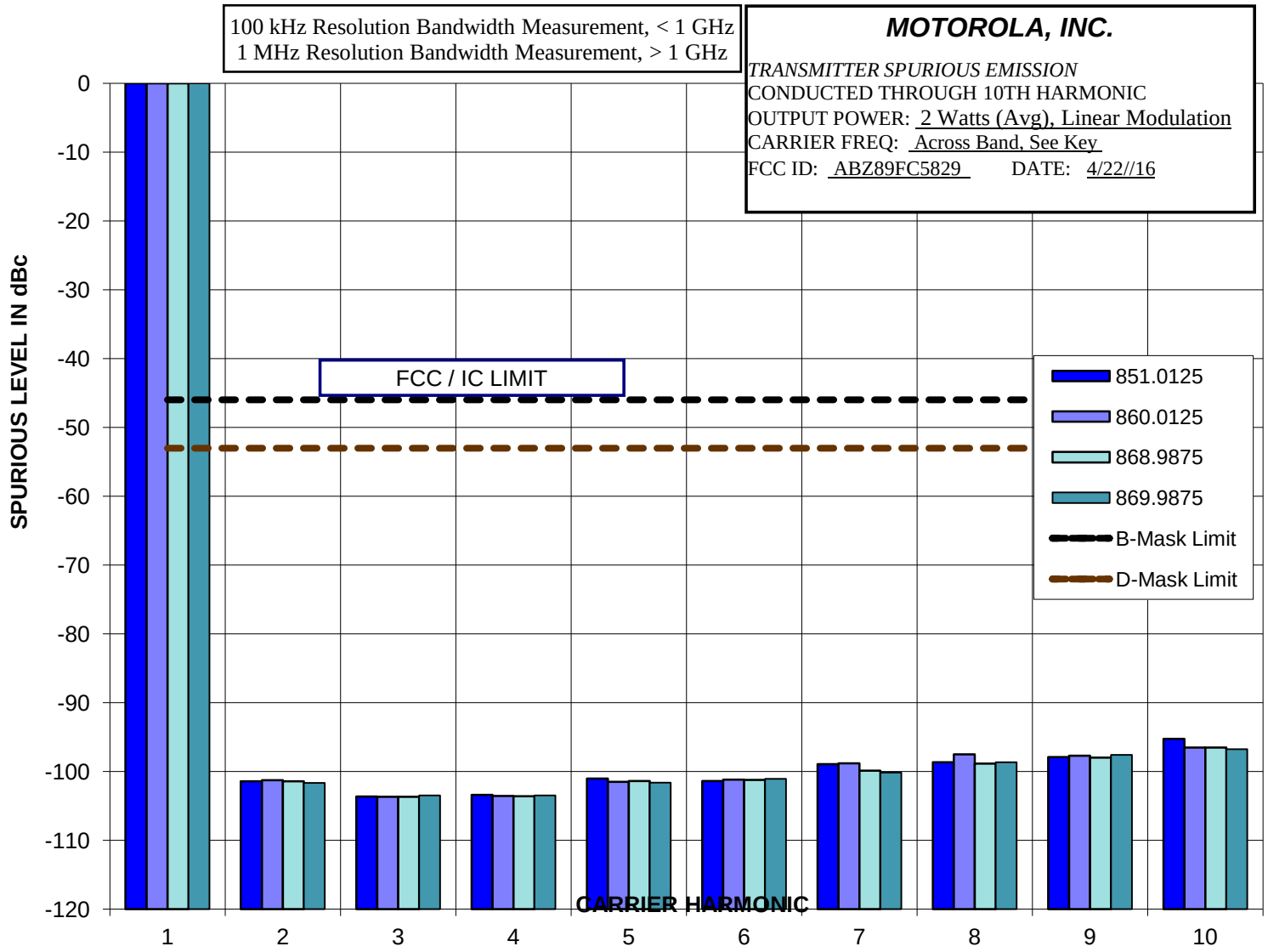
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 33 Watts (Average) LSM



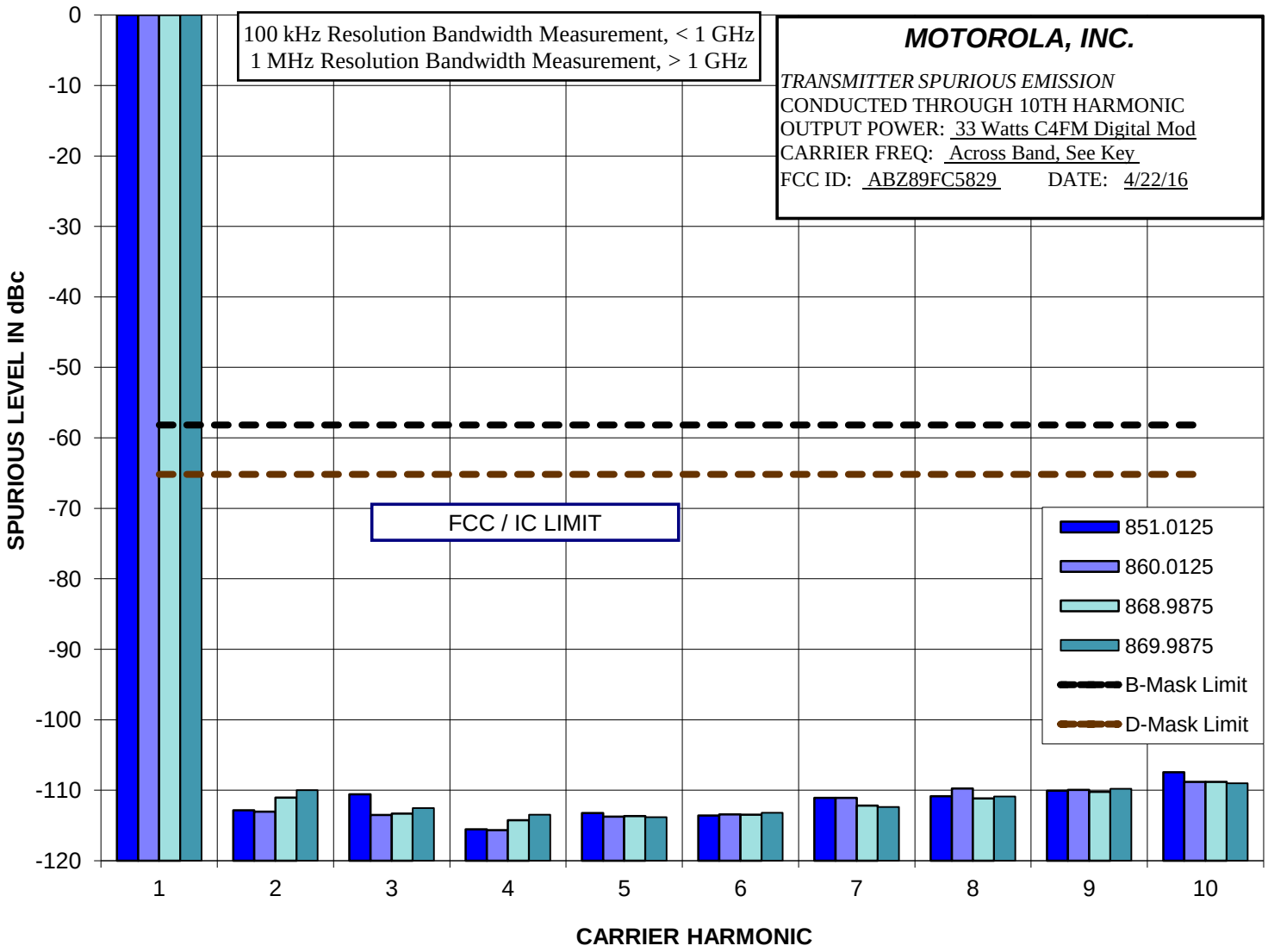
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 2 Watts (Average) LSM



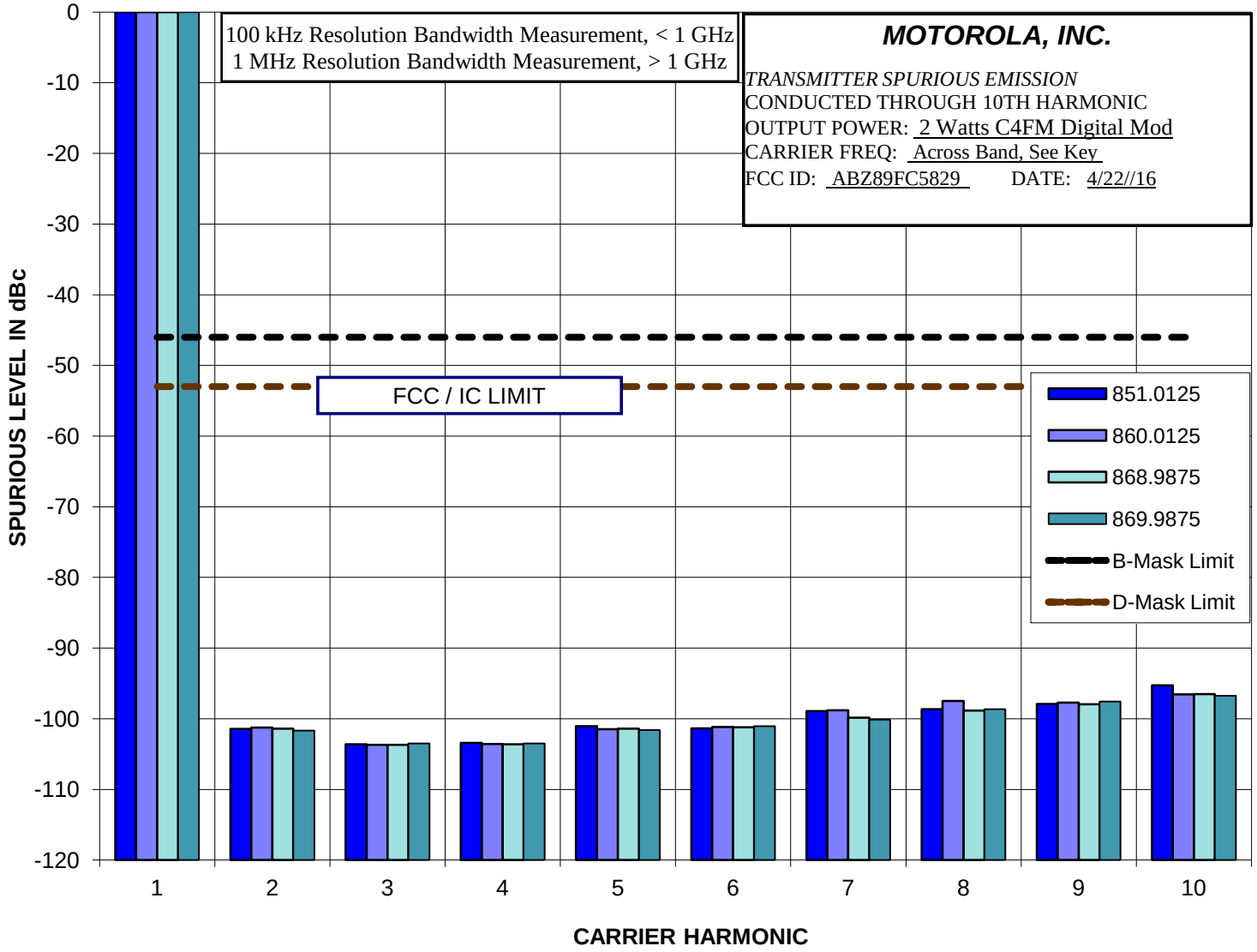
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 33 Watts C4FM



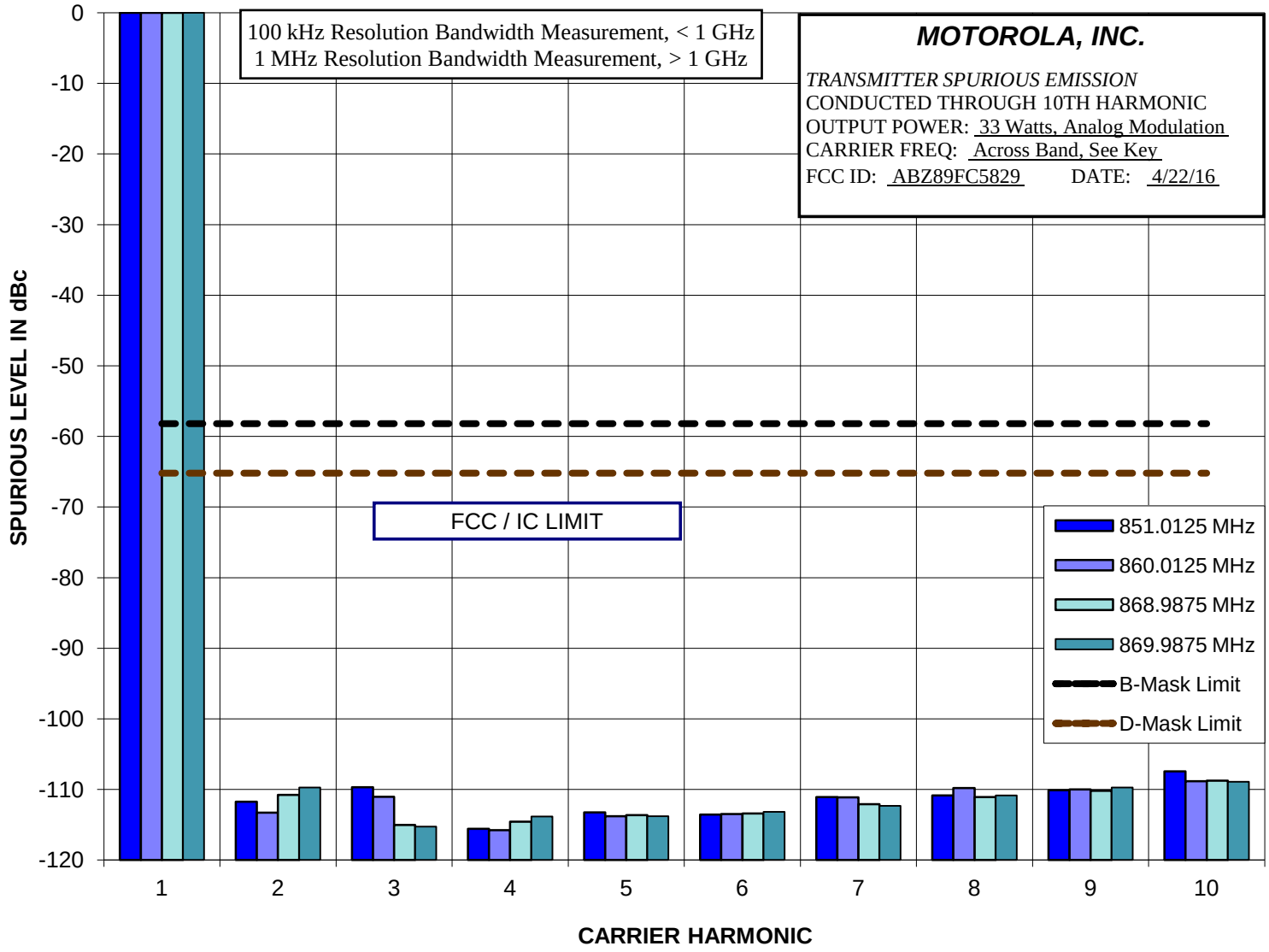
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 2 Watts C4FM



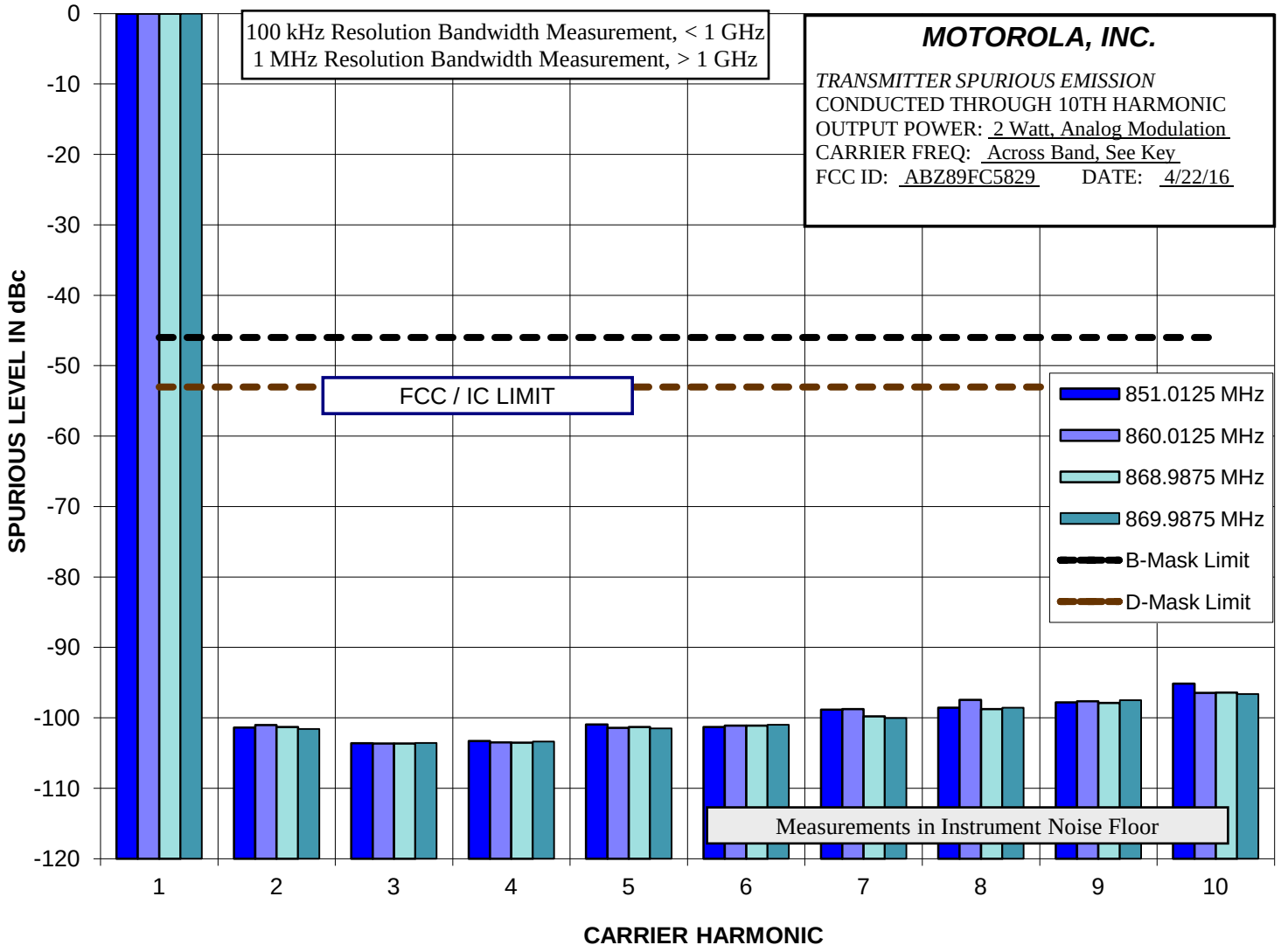
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 33 Watts Analog Modulation



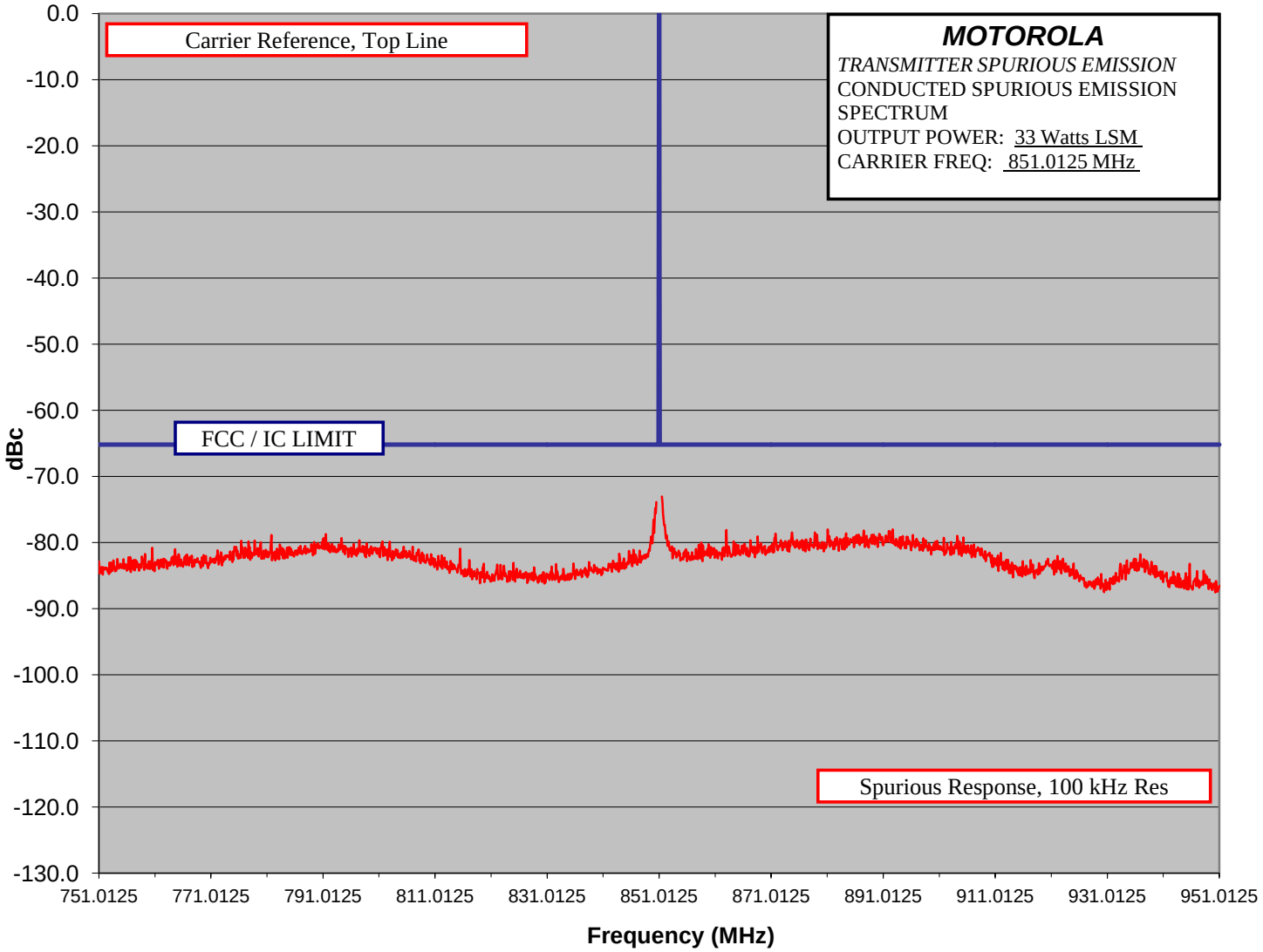
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 2 Watts Analog Modulation



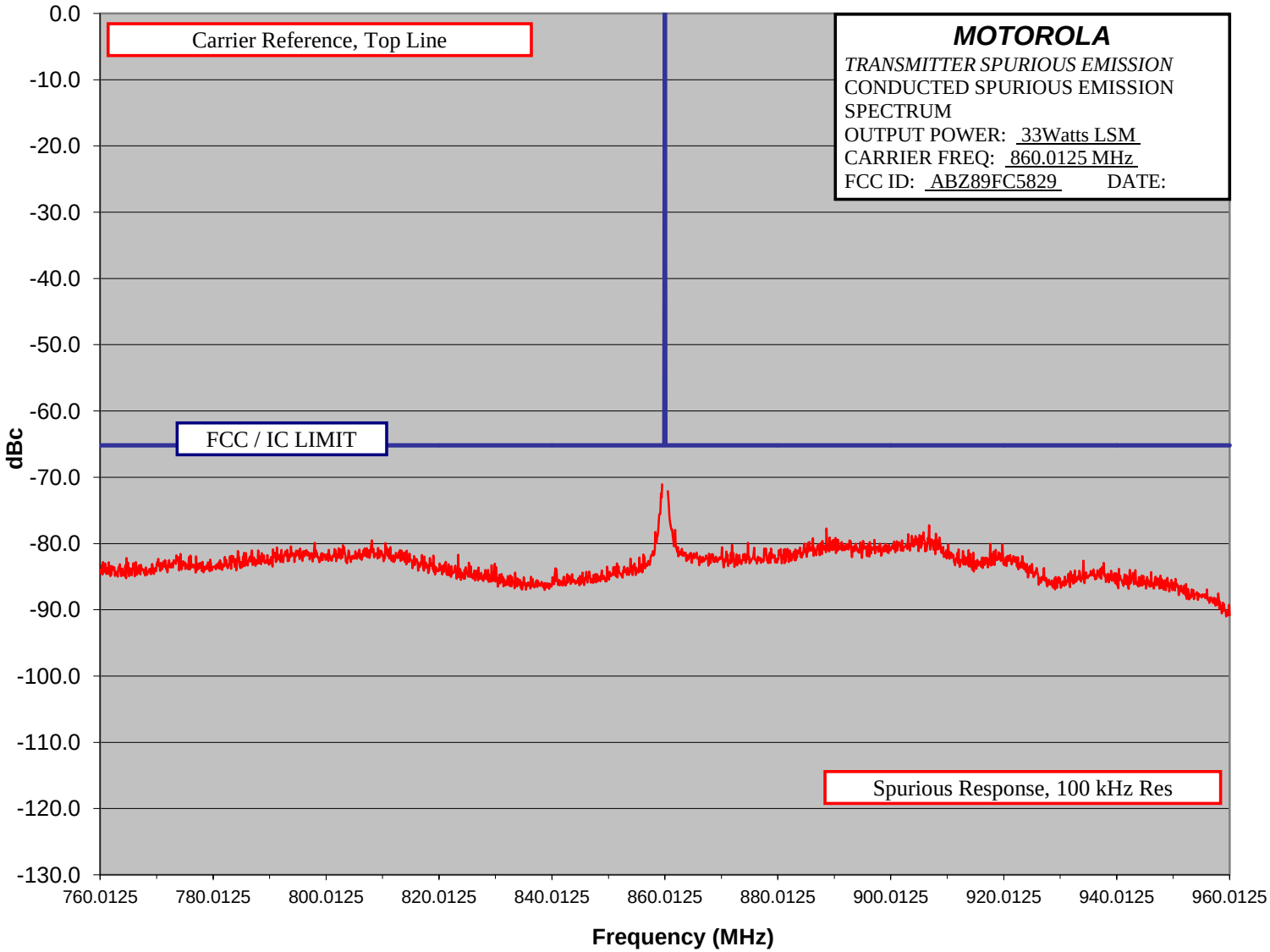
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts (Average) LSM – *200 MHz Span – Low End of Band*



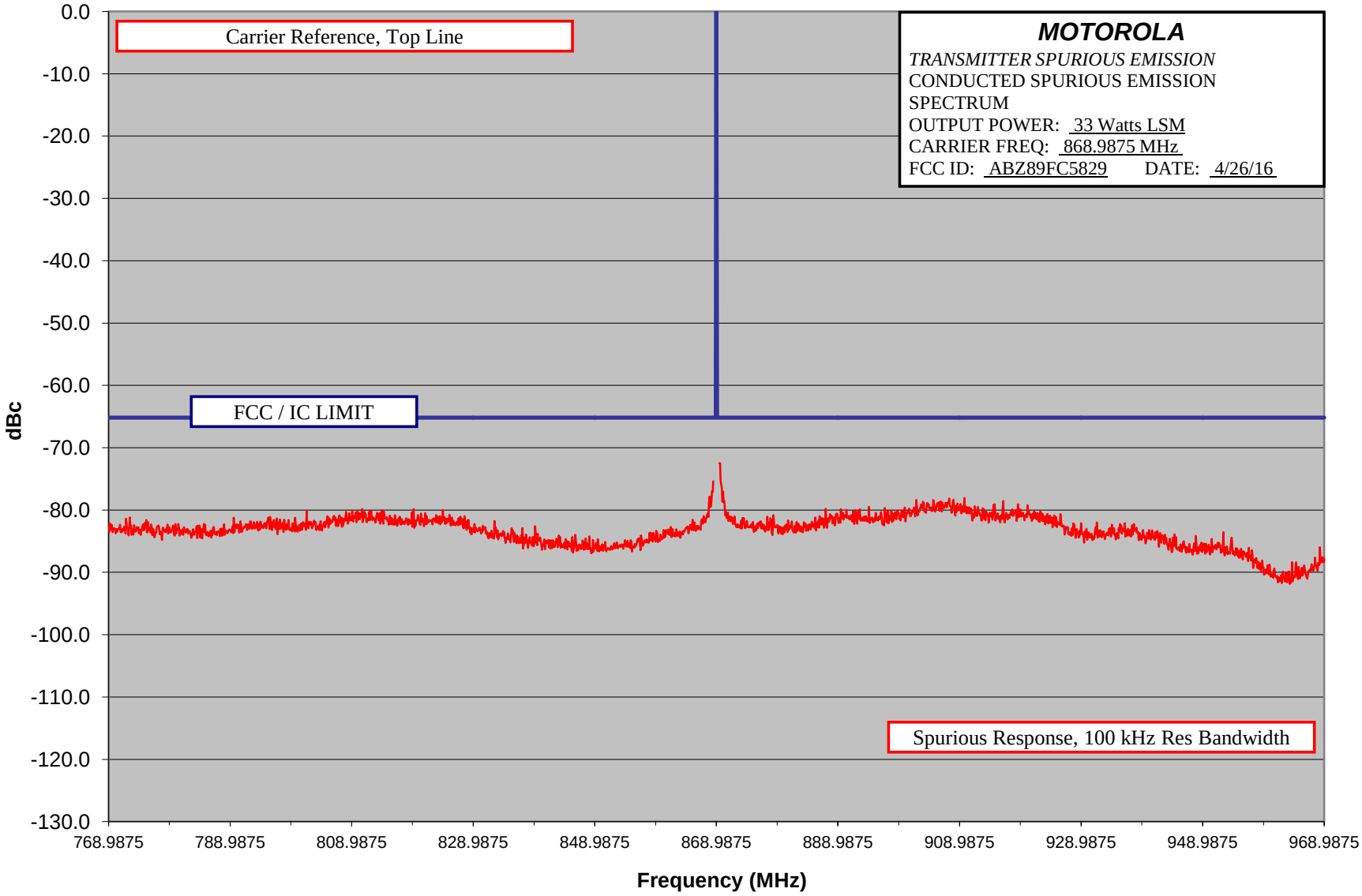
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts (Average) LSM – *200 MHz Span – Middle of Band*



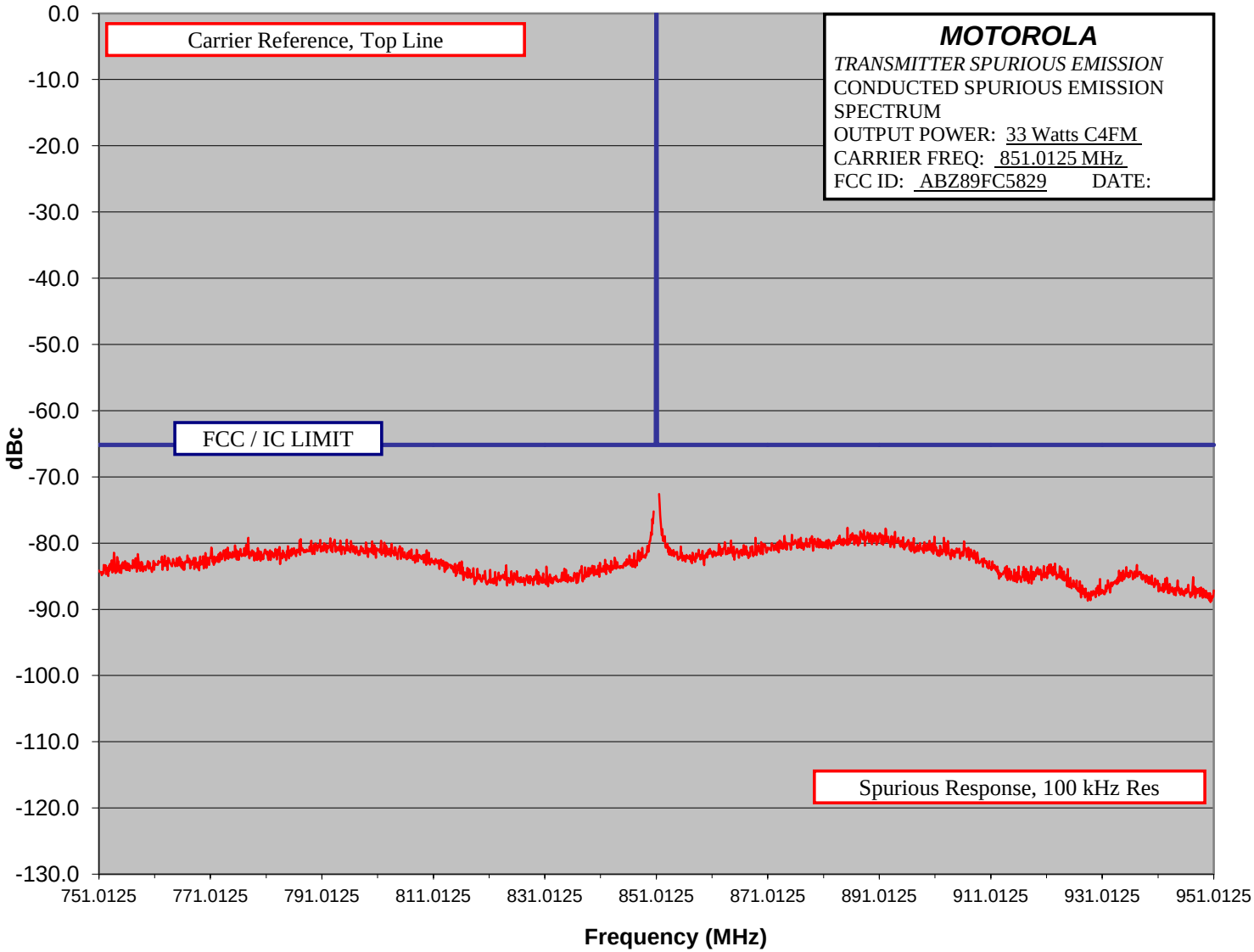
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts (Average) LSM – *200 MHz Span – High End of Band*



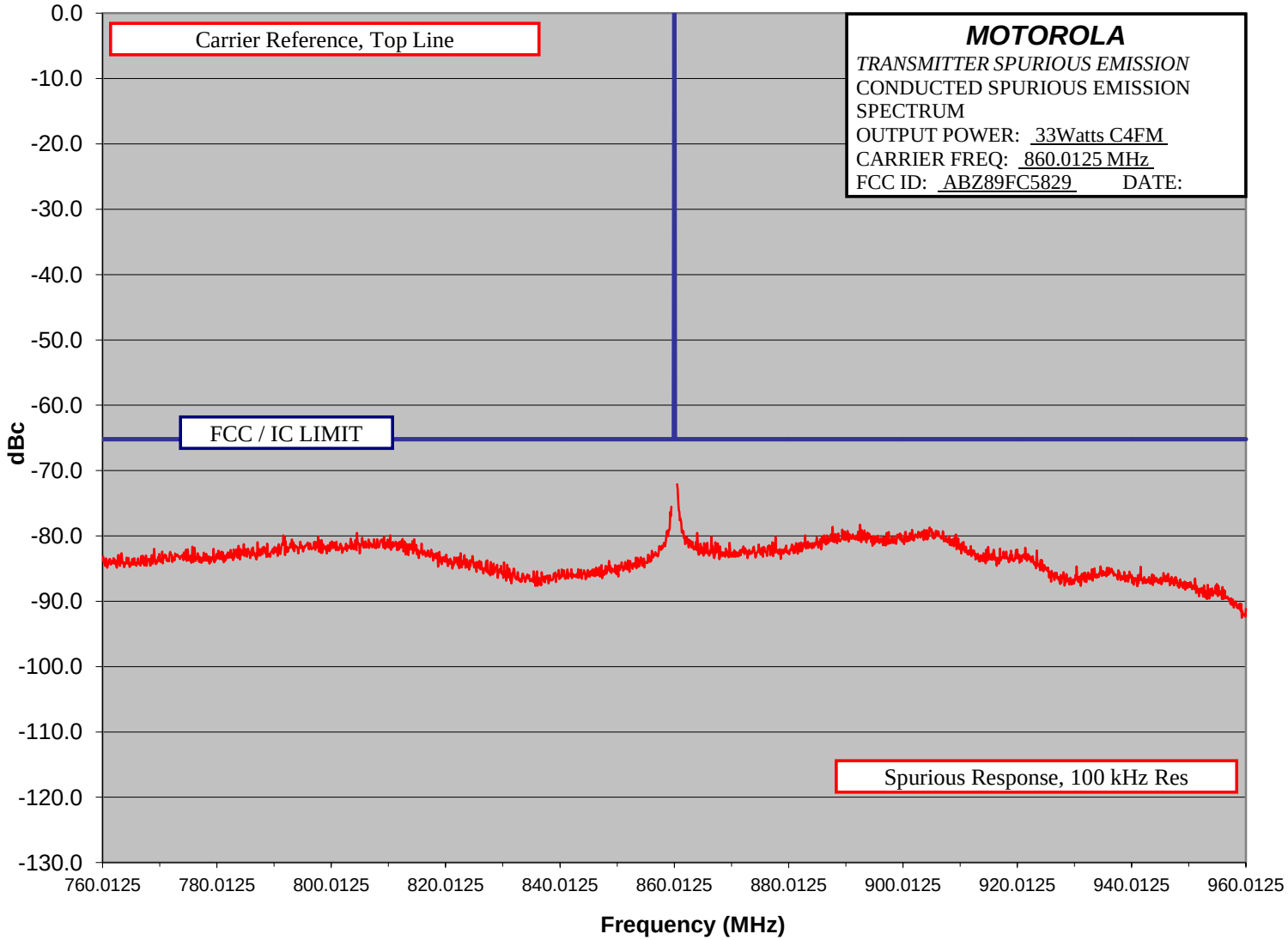
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts C4FM – *200 MHz Span – Low End of Band*



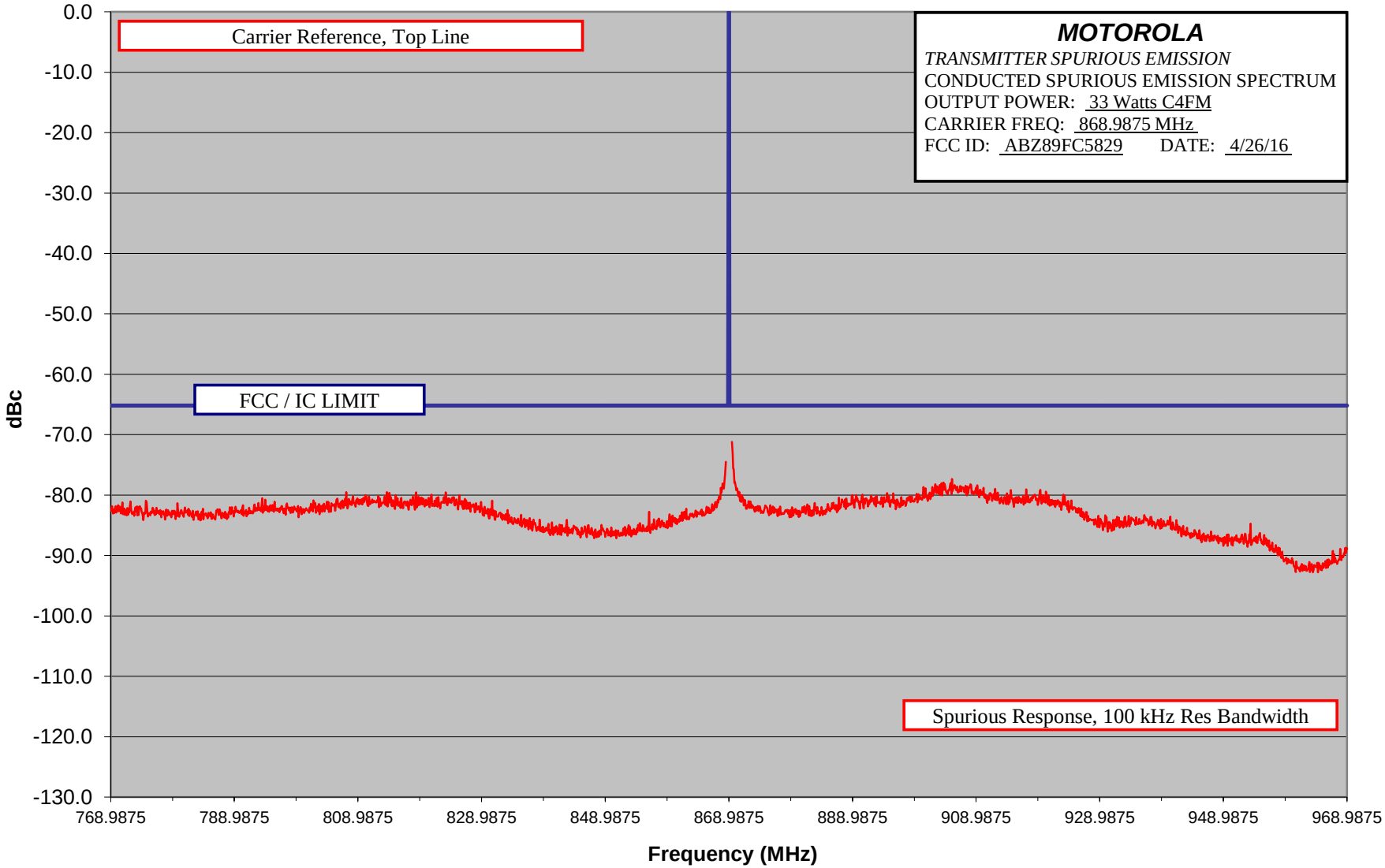
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts C4FM – *200 MHz Span – Middle of Band*



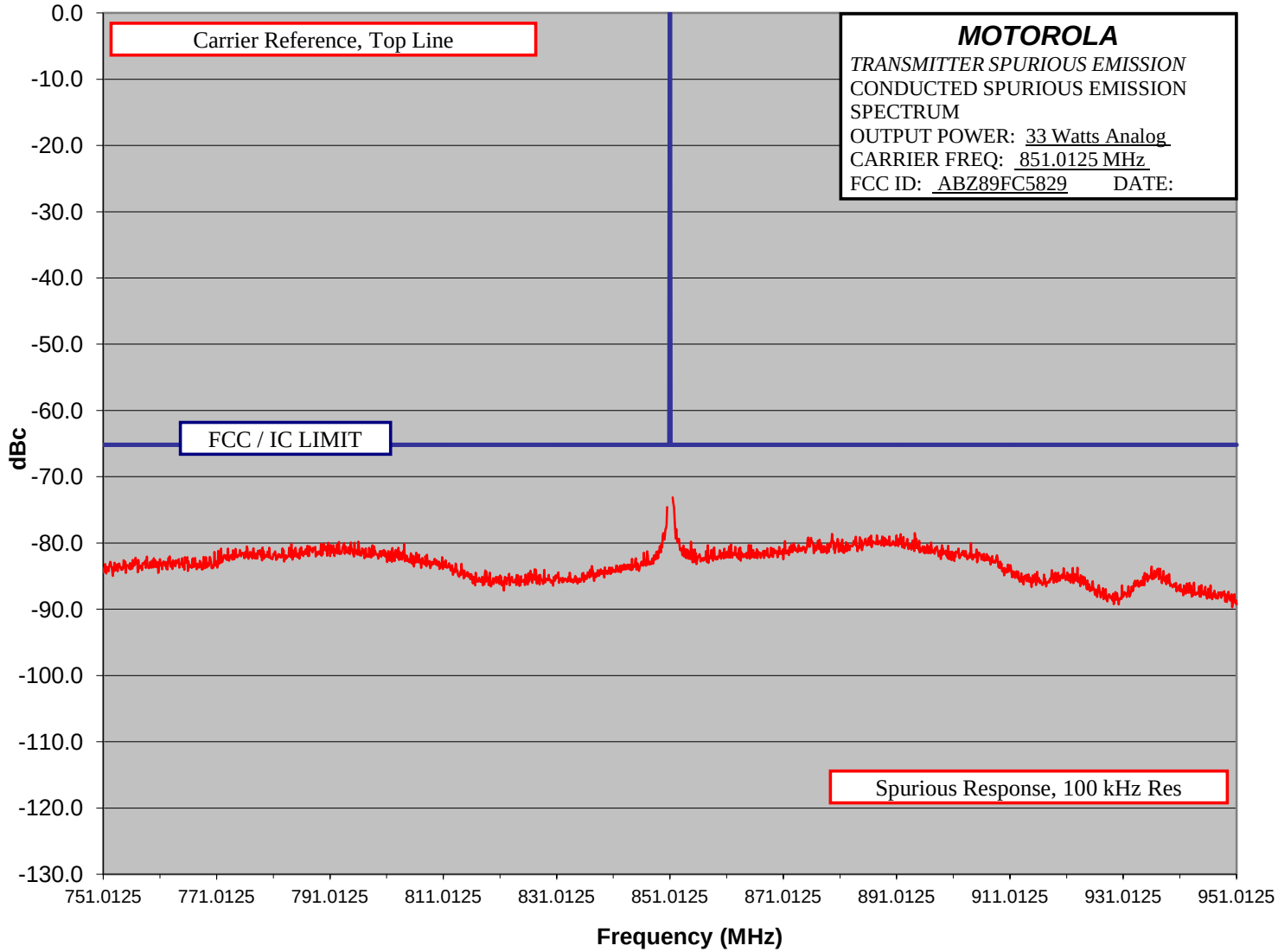
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts C4FM – *200 MHz Span – High End of Band*



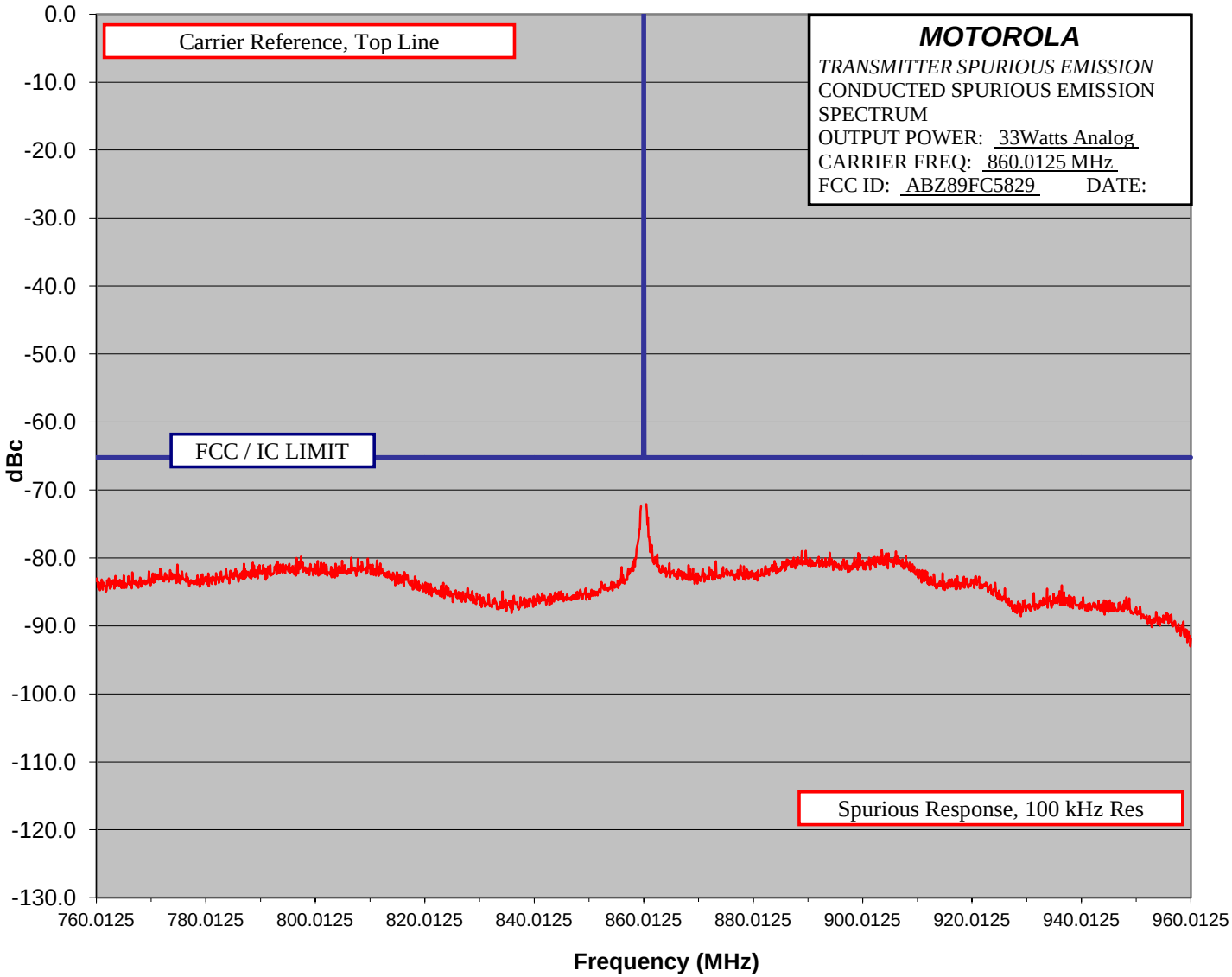
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts Analog – *200 MHz Span – Low End of Band*



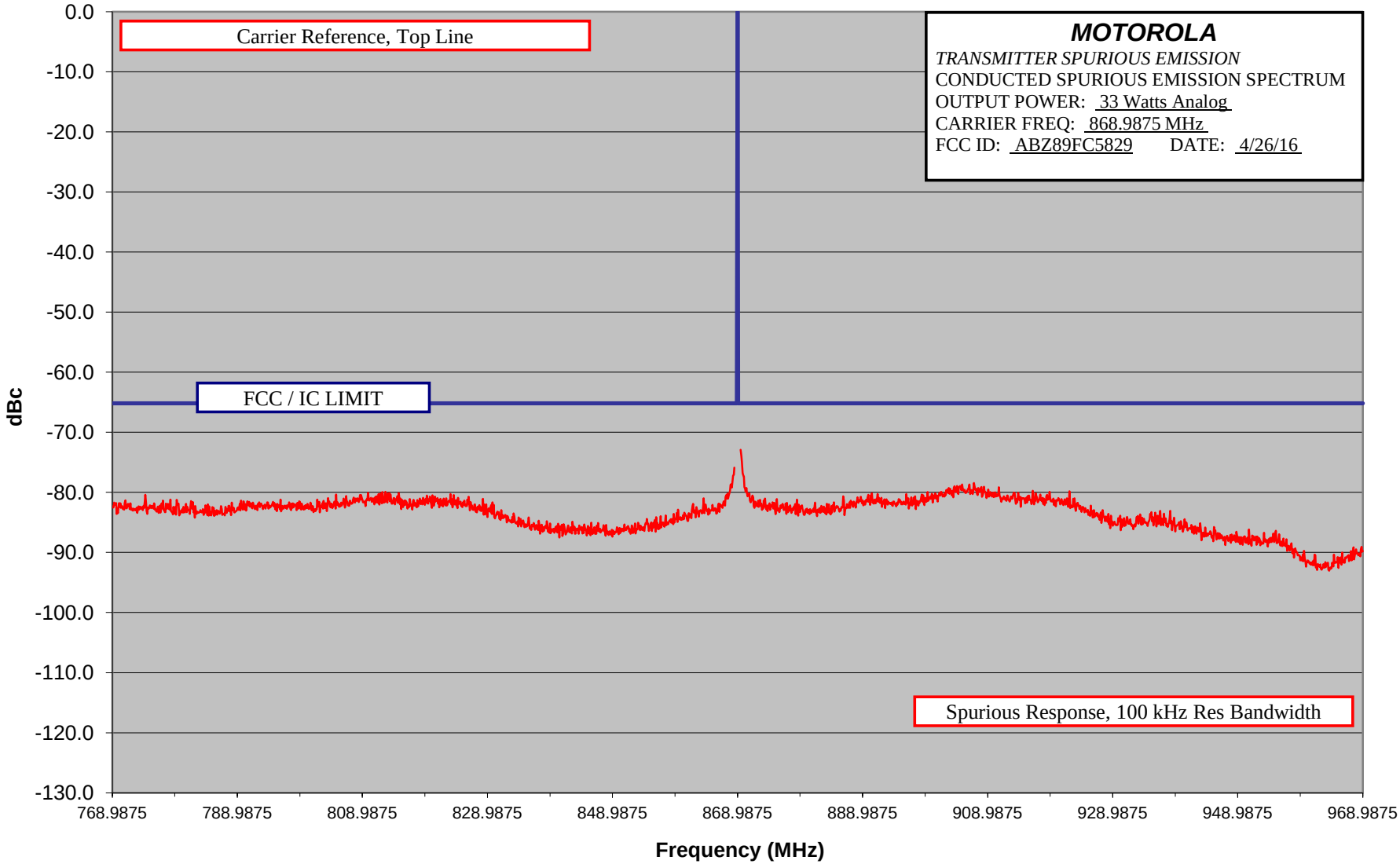
Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts Analog – *200 MHz Span – Middle of Band*



Report on Test Measurements

Conducted Spurious Emission Spectrum – 33 Watts Analog – *200 MHz Span – High End of Band*



Report on Test Measurements

Radiated Spurious Emissions, Harmonics

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:

On any frequency removed from the assigned frequency by a displacement frequency (Fd in kHz) of:
c) >50 kHz *at least 43+10 * Log10 (P) dB.*

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D:* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log10(P) dB or 70 dB, whichever is the lesser attenuation.*

Specification Requirement § 90.210(g) and IC RSS-119 section 5.8.6 - Emission Limits – "G-Mask":
Emission *Mask G.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least 43 + 10 log (P) dB*.

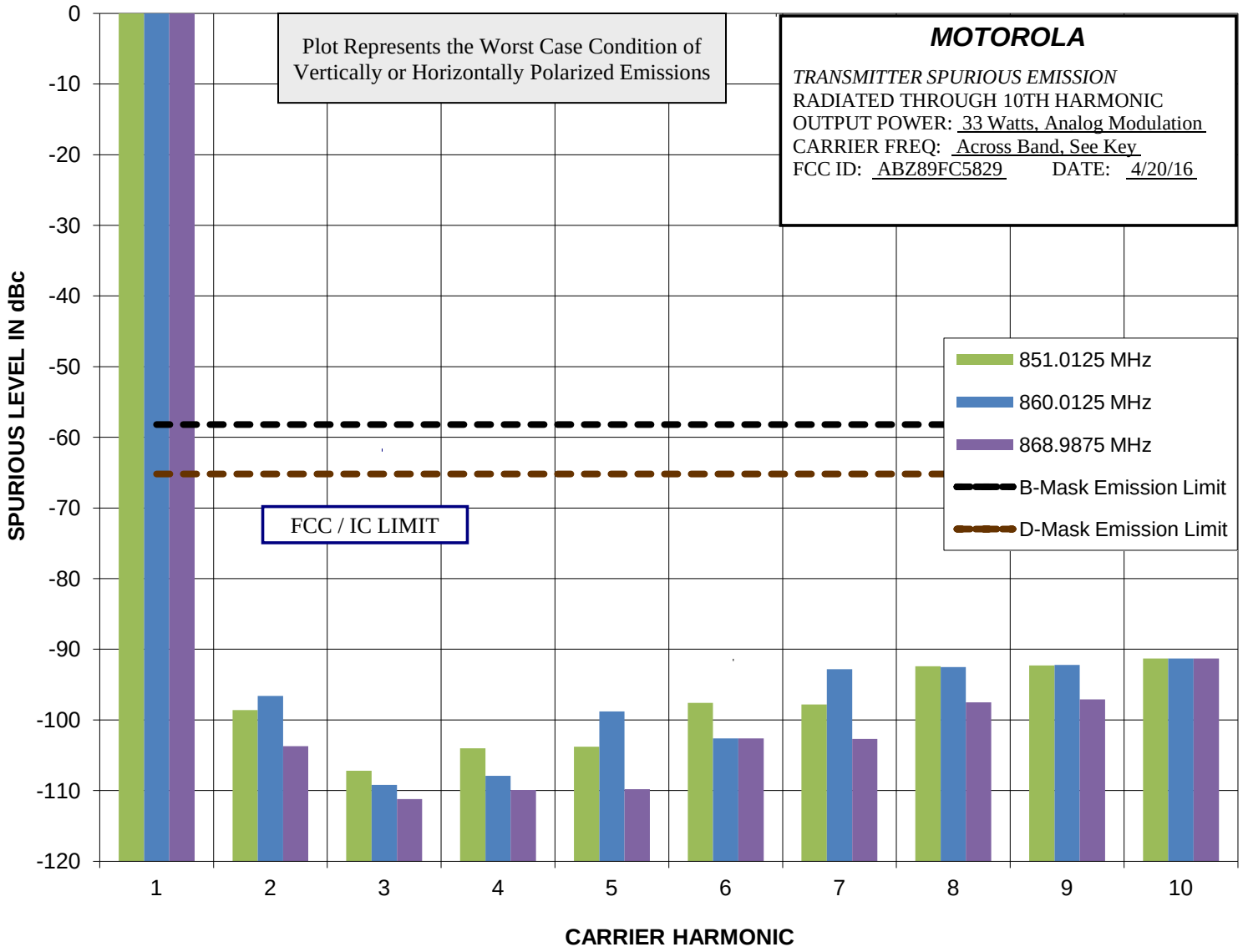
Modulation: Analog Frequency Modulation – this is also representative of the performance of Linear Simulcast Modulation (LSM), or Compatible 4-Level Frequency Modulation (C4FM)

Carrier Frequencies: Carrier frequencies of 851.0125, 860.0125, and 868.9875 MHz were measured for conducted carrier harmonics and conducted emission. These frequencies represent the low end, center, and high end of the 851-870 MHz band, and are representative of the full operating band

EXHIBIT	DESCRIPTION
E1-4.1	Radiated Spurious Harmonic Emissions, Power Output 33 Watts The specification limit is -65.2 dBc
E1-4.2	Radiated Spurious Harmonic Emissions, Power Output 2 Watt The specification limit is -53.0 dBc

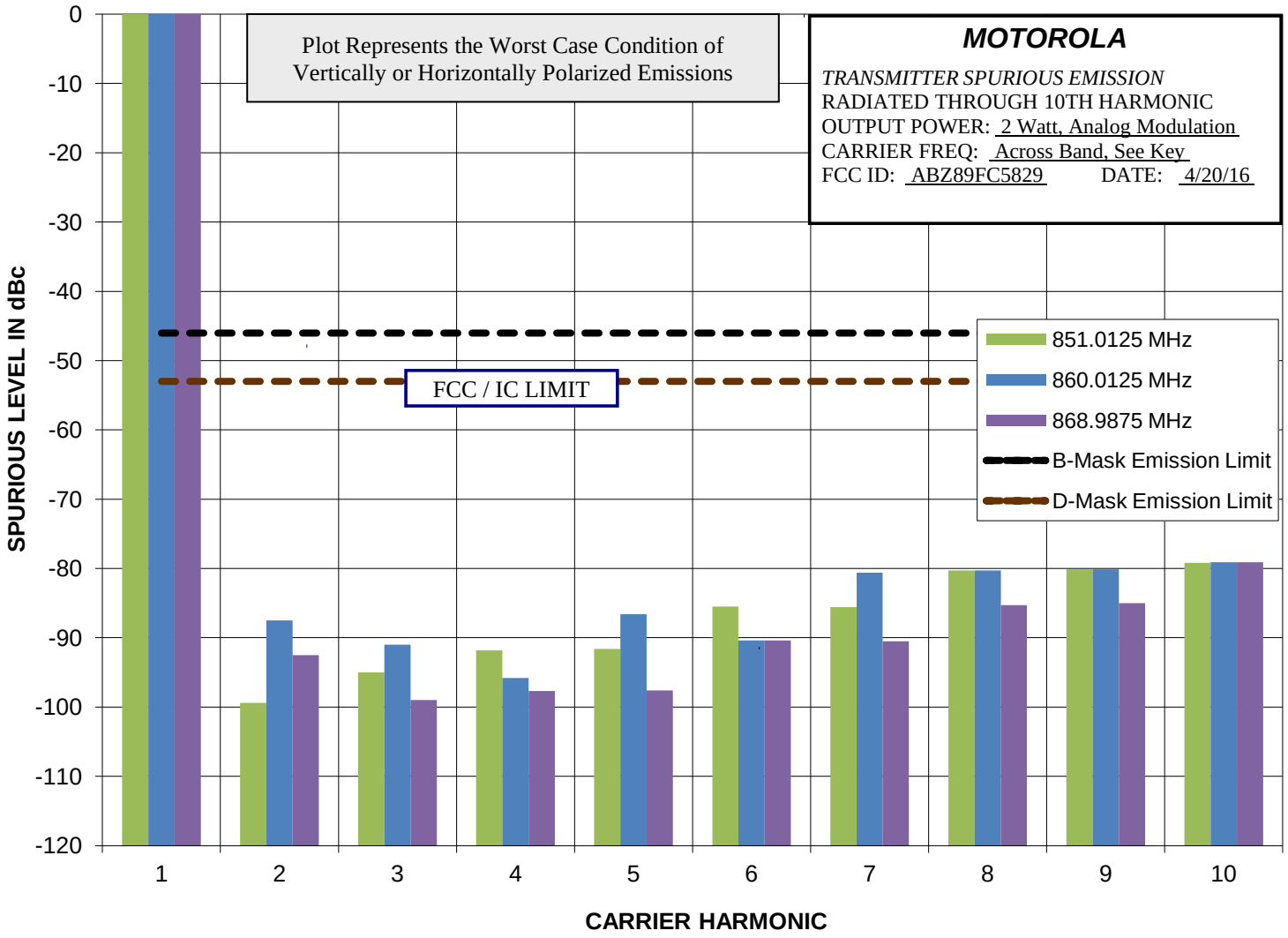
Report on Test Measurements

Radiated Spurious Harmonic Emissions — 110 Watts



Report on Test Measurements

Radiated Spurious Harmonic Emissions — 12 Watt



Report on Test Measurements

Oscillator Frequency Stability

Manufacturer data for the system site frequency standard was used in generation of the following frequency stability exhibits.

Specification Requirement: Reference RSS-119 Section 5.3

Fixed and Base stations operating at 851-866 MHz and 866-869 MHz must have a frequency stability of better than +/- 1.0 PPM for 12.5 kHz channel spacing and +/- 1.5 PPM for 25 kHz channel spacing.

Specification Requirement: Reference Part 90.213

Fixed and Base stations operating at 851-854 must have a frequency stability of better than +/- 1.0 PPM.

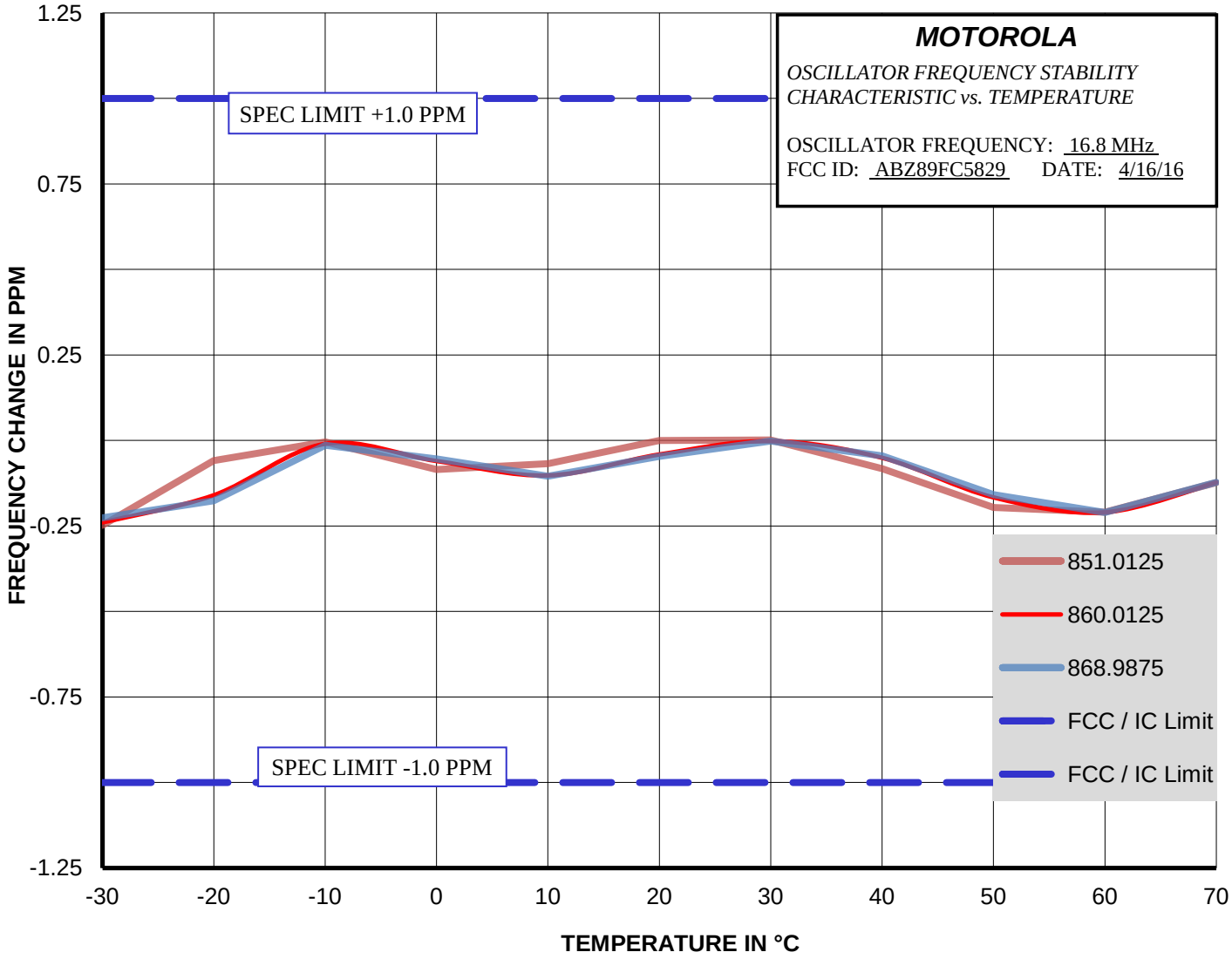
Fixed and Base stations operating at 854-869 must have a frequency stability of better than +/- 1.5 PPM.

Only the more stringent specification limit is shown on the frequency stability exhibits.
Performance was measured at carrier frequencies across the operating band.

EXHIBIT	DESCRIPTION
E1-5.1	Frequency Stability Vs Temperature
E1-5.2	Frequency Stability Vs Voltage

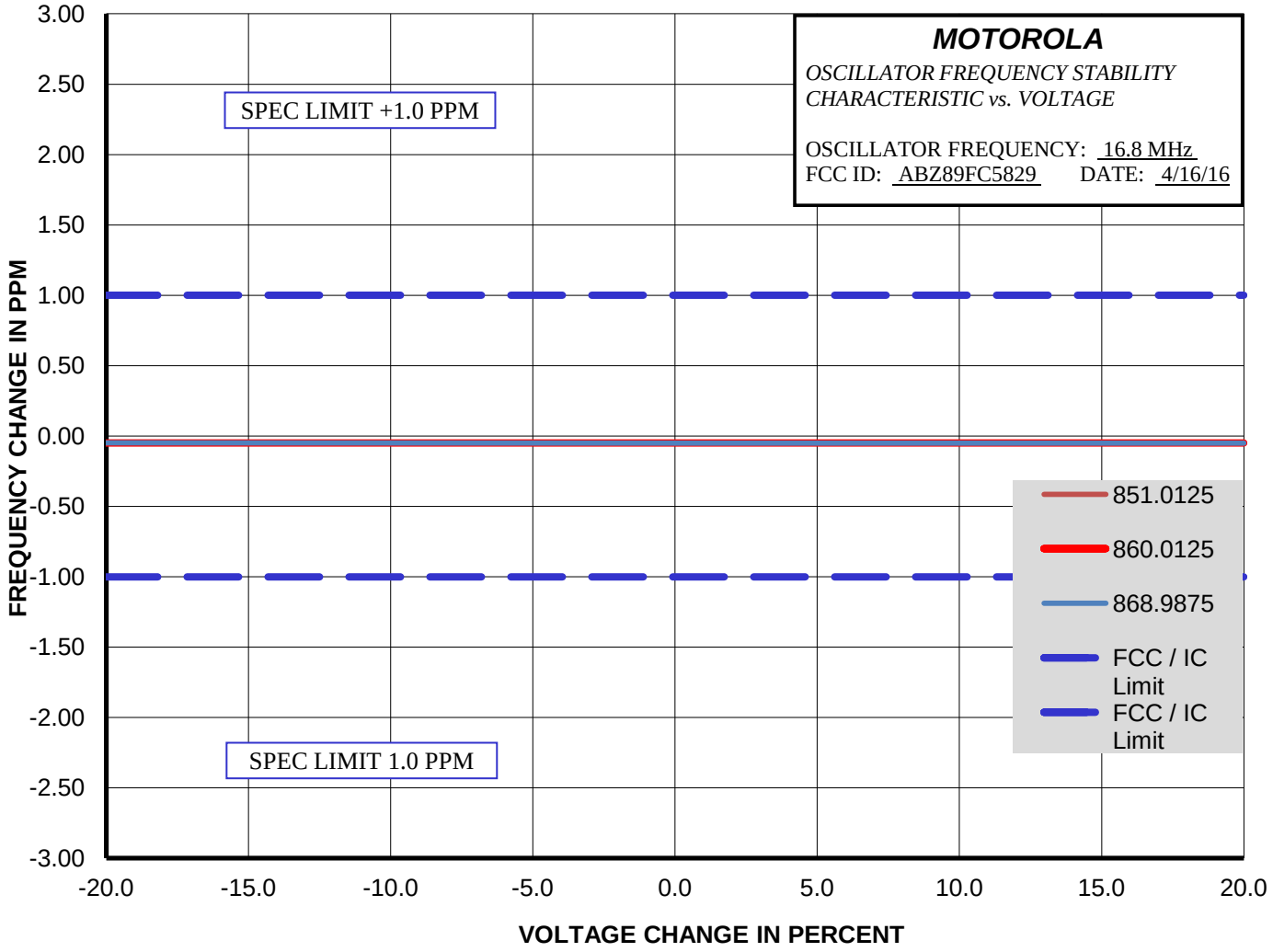
Report on Test Measurements

Frequency Stability Vs Temperature



Report on Test Measurements

Frequency Stability Vs Voltage



Report on Test Measurements

Audio Frequency Response

Specification Requirement per TIA 603:
Audio Frequency Response, 25 kHz Channels*:* The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, with an additional 6 dB per octave attenuation allowed from 500 Hz to 300 Hz, and an additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.

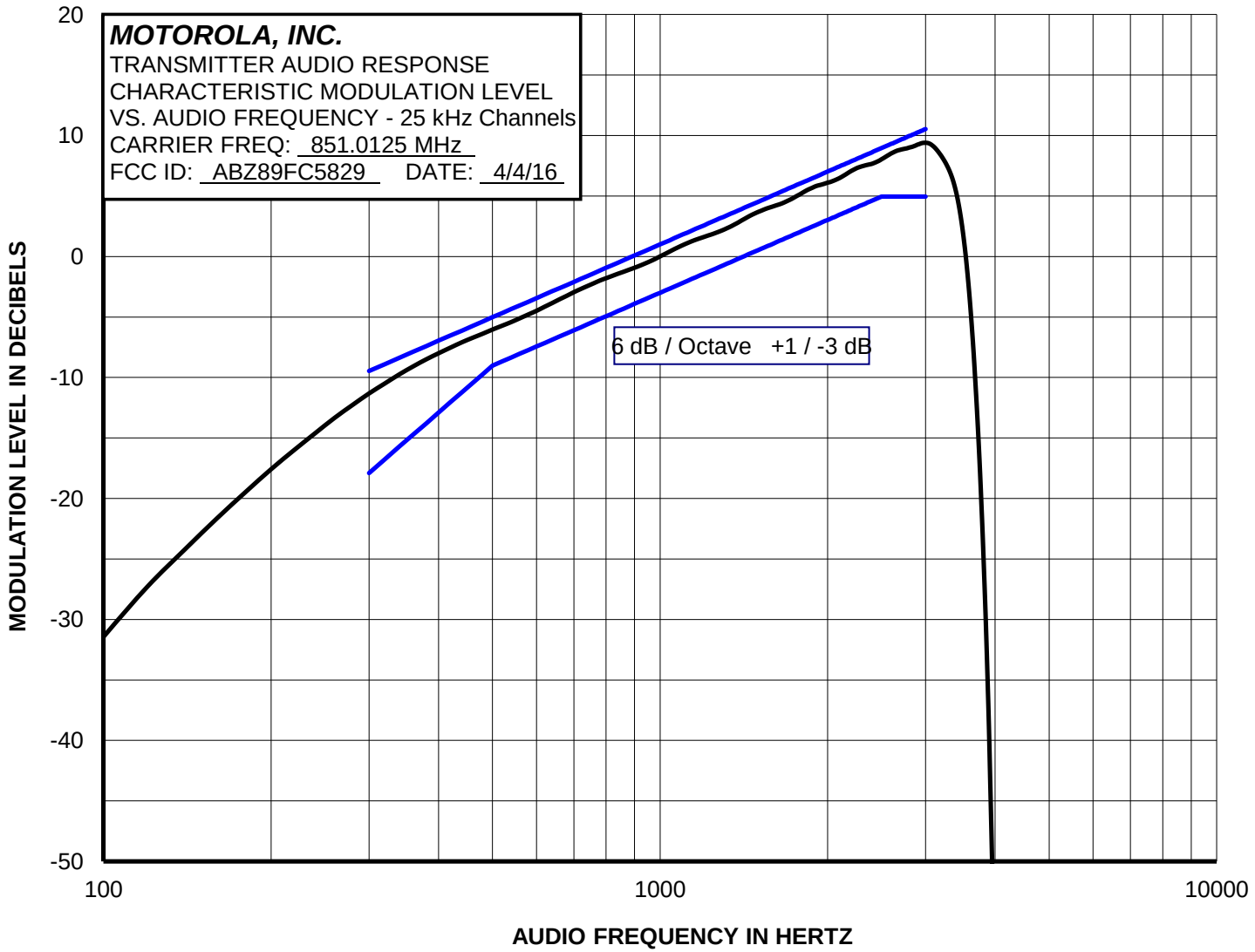
Audio Frequency Response, 12.5 kHz Channels*:* The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, with an additional 6 dB per octave attenuation allowed from 500 Hz to 300 Hz. An additional 6 dB per octave rolloff is allowed from 2300 Hz to 2700 Hz, and an additional 12 dB per octave is allowed from 2700 Hz to 3000 Hz in equipment operating in the 896 MHz to 940 MHz range or for 12.5 kHz channel operation.

Modulation:	Audio Test Tone
Carrier Frequency:	Performance was measured at carrier frequencies at the low end, middle, and high end of the operating band. For performance in the FCC NPSPAC band, a carrier frequency in the 851-854 MHz range was also measured.
Specification:	The specification limit is shown on the response plots

EXHIBIT	DESCRIPTION
E1-6.1	Audio Frequency Response – Modulation Characteristics, 25 kHz Channels – Low End of Band
E1-6.2	Audio Frequency Response – Modulation Characteristics, 25 kHz Channels – Middle of Band
E1-6.3	Audio Frequency Response – Modulation Characteristics, 25 kHz Channels – High End of Band
E1-6.4	Audio Frequency Response – Modulation Characteristics, 12.5 kHz Channels – Low End of Band
E1-6.5	Audio Frequency Response – Modulation Characteristics, 12.5 kHz Channels – Middle of Band
E1-6.6	Audio Frequency Response – Modulation Characteristics, 12.5 kHz Channels – High End of Band
E1-6.7	Audio Frequency Response – Modulation Characteristics, NPSPAC Channels

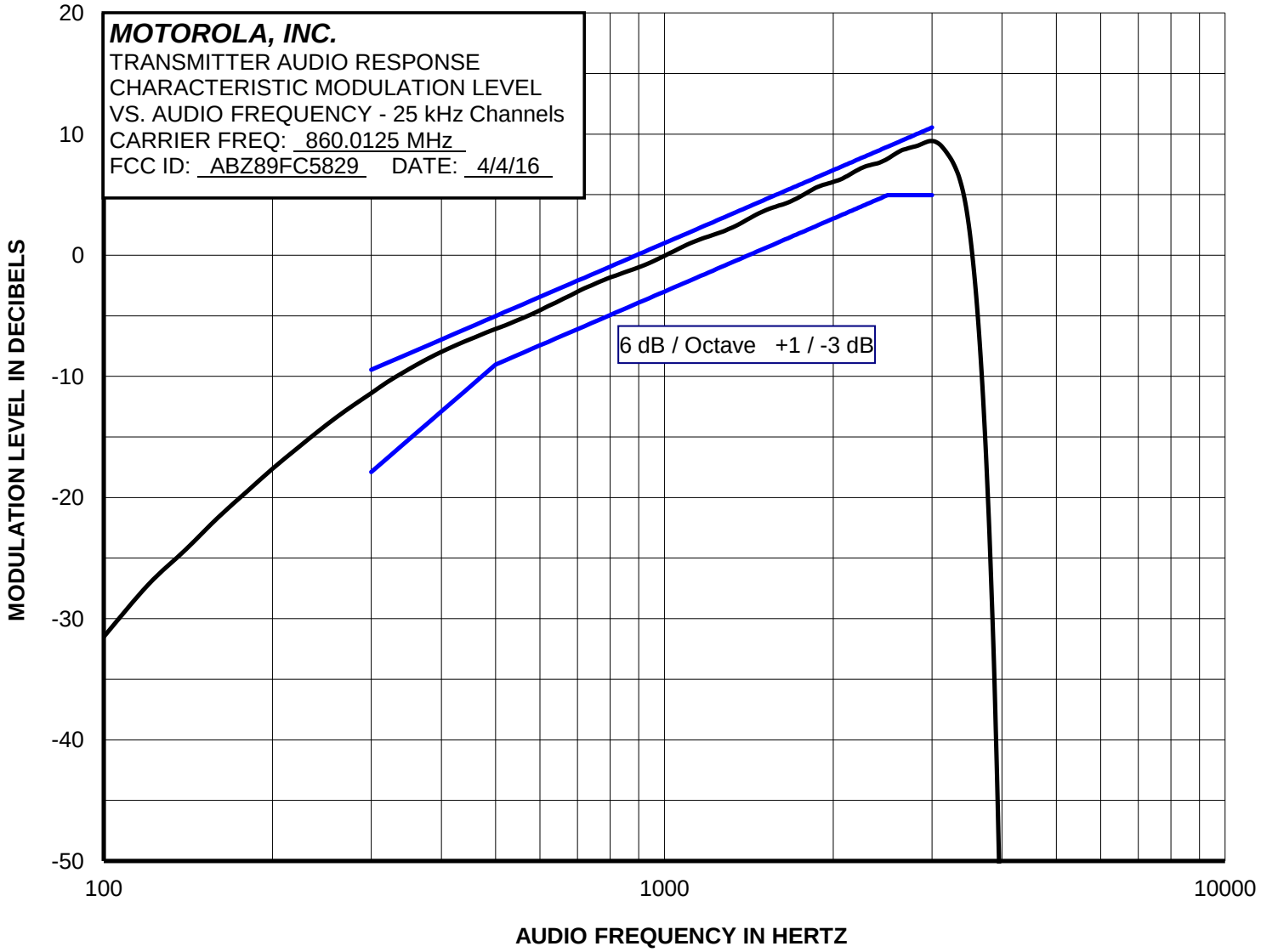
Report on Test Measurements

Audio Frequency Response – 25 kHz Channels



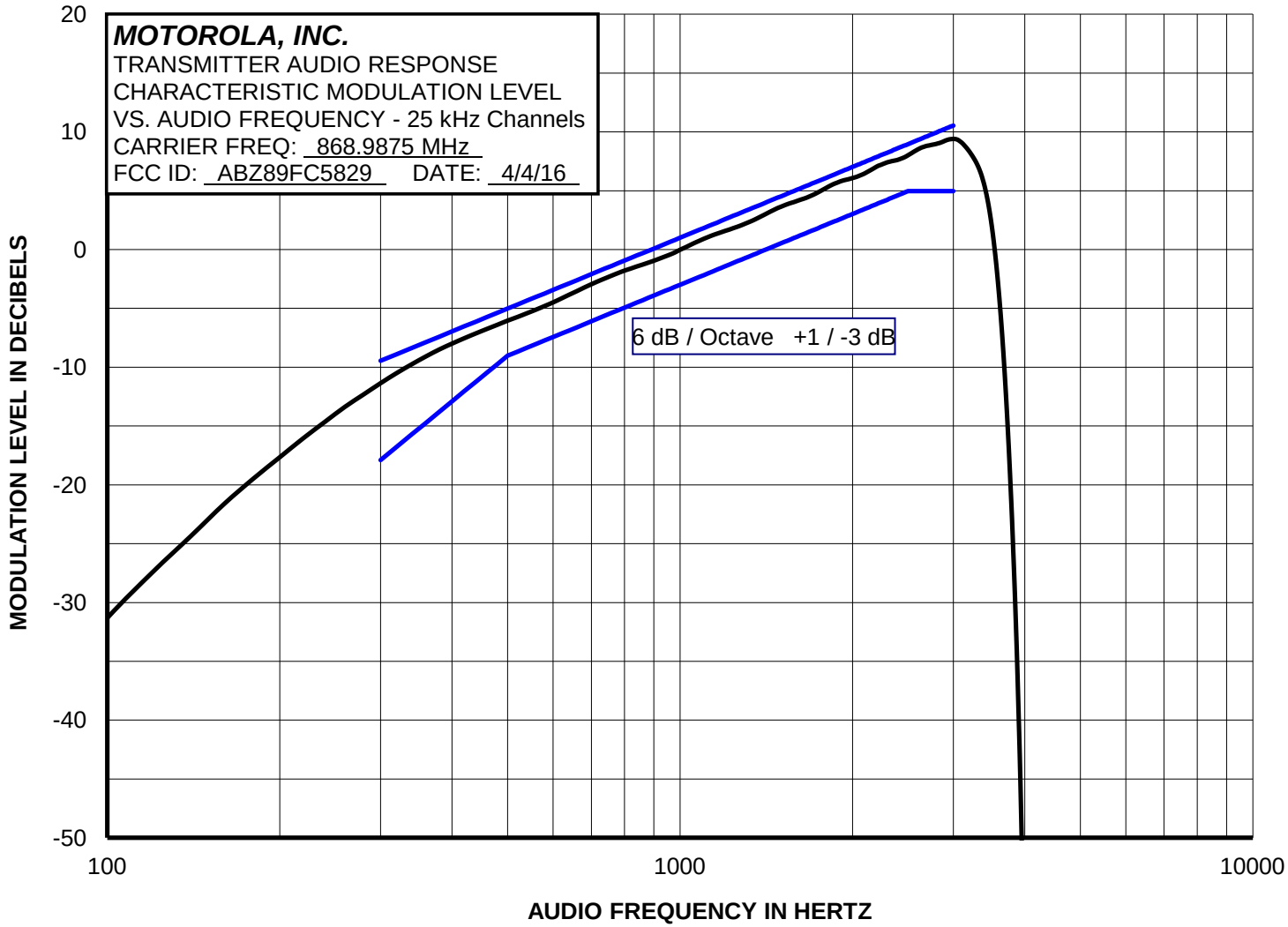
Report on Test Measurements

Audio Frequency Response – 25 kHz Channels



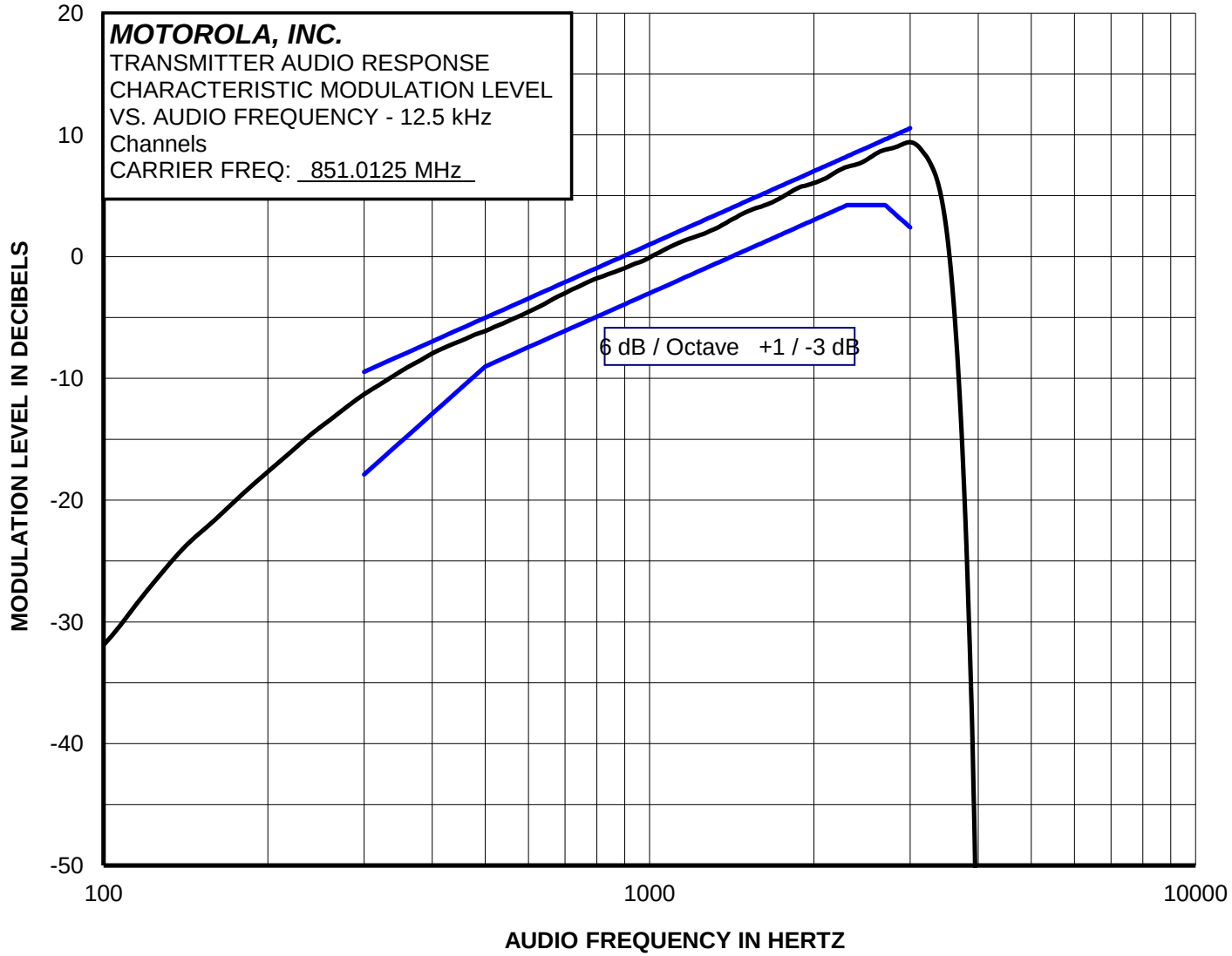
Report on Test Measurements

Audio Frequency Response – 25 kHz Channels



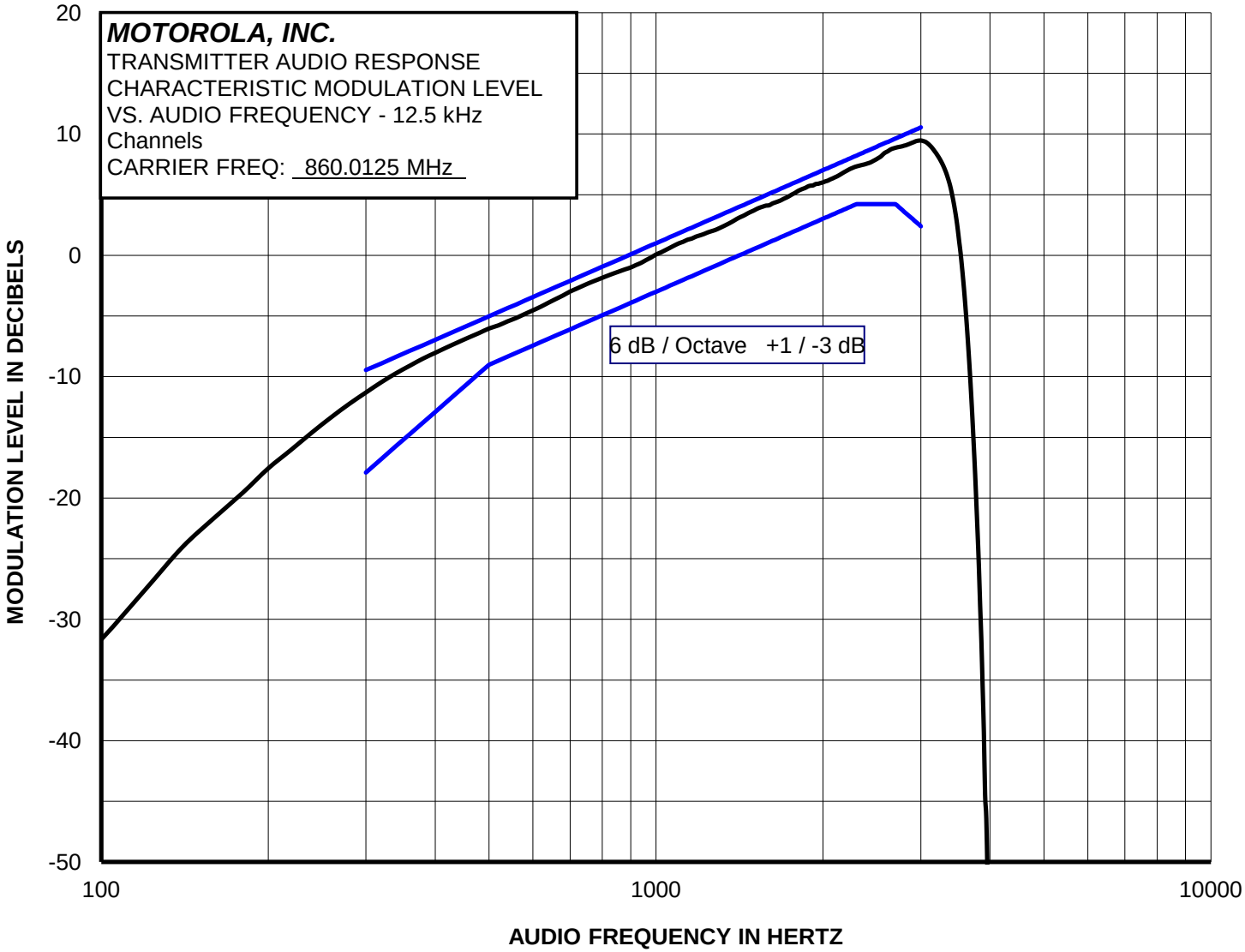
Report on Test Measurements

Audio Frequency Response – 12.5 kHz Channels



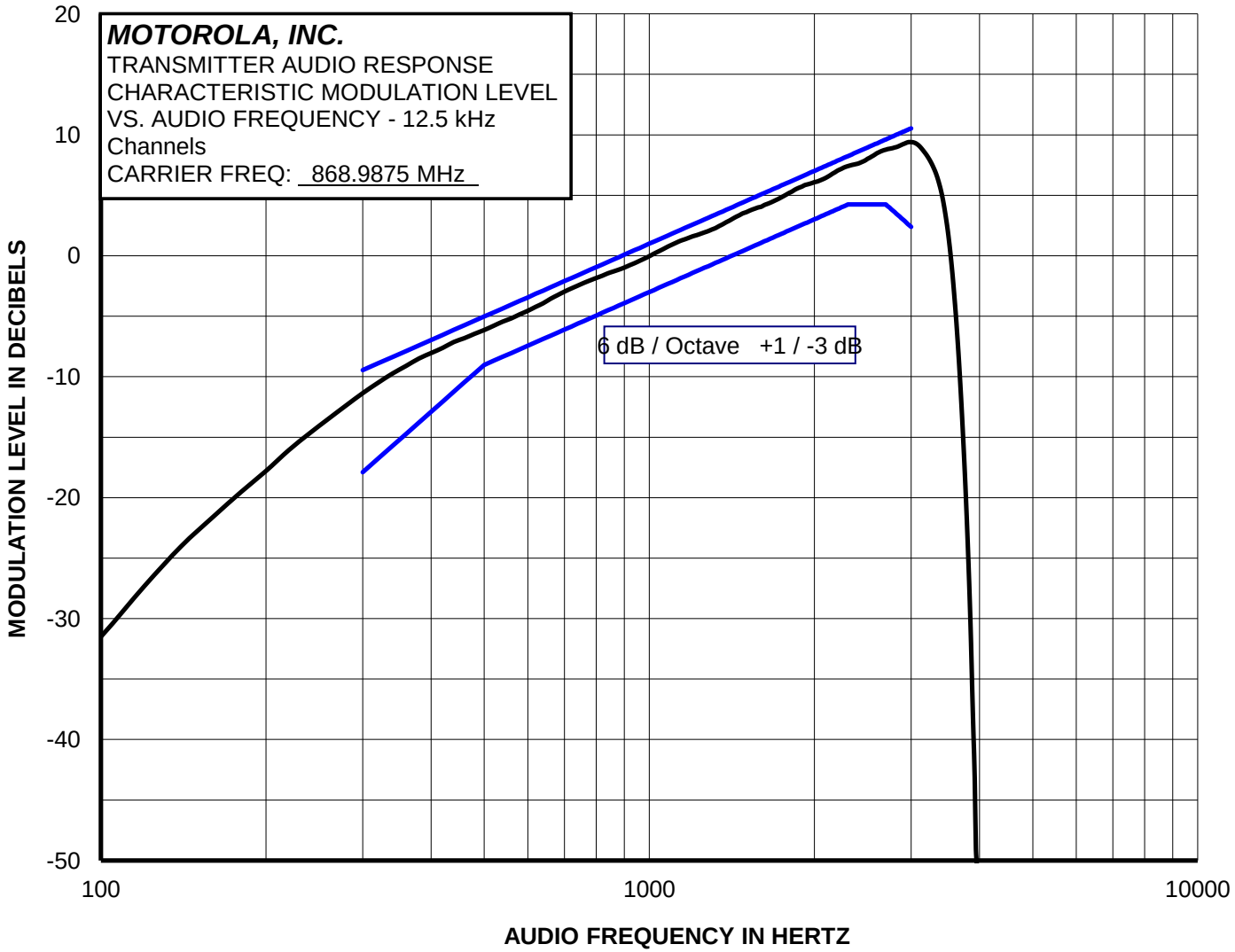
Report on Test Measurements

Audio Frequency Response – 12.5 kHz Channels



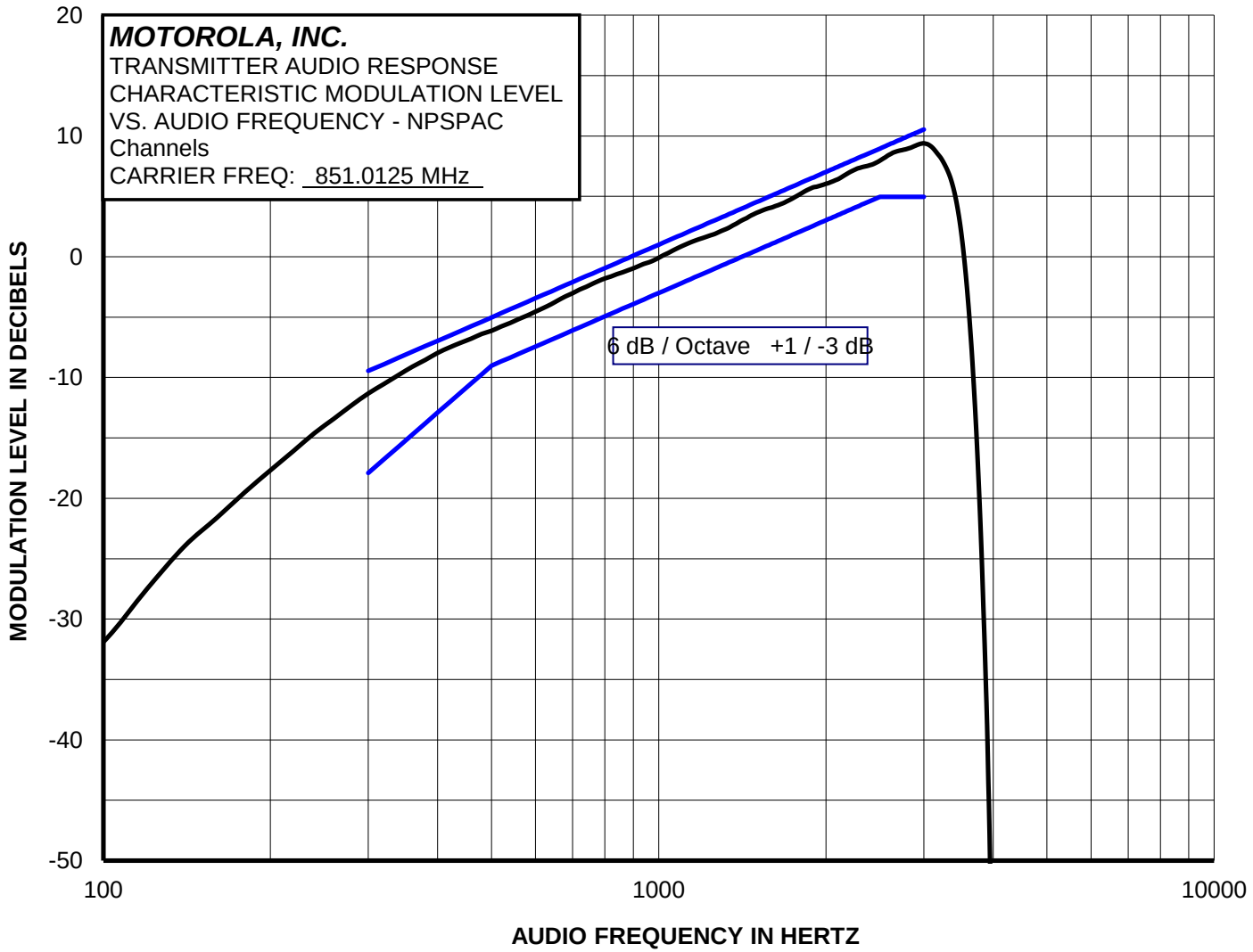
Report on Test Measurements

Audio Frequency Response – 12.5 kHz Channels



Report on Test Measurements

Audio Frequency Response – NPSPAC Channels



Report on Test Measurements

Modulation Limiting

Specification Requirement per TIA 603:
Modulation Limiting, 25 kHz Channels*:* The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 5 kHz at any audio frequency or change in level as specified in the method of measurement.

The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 3 kHz.

Modulation Limiting, 12.5 kHz Channels*:* The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 2.5 kHz at any audio frequency or change in level as specified in the method of measurement.

The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 1.5 kHz.

Modulation Limiting, NPSPAC Channels: The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 4 kHz at any audio frequency or change in level as specified in the method of measurement.

The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 2.4 kHz.

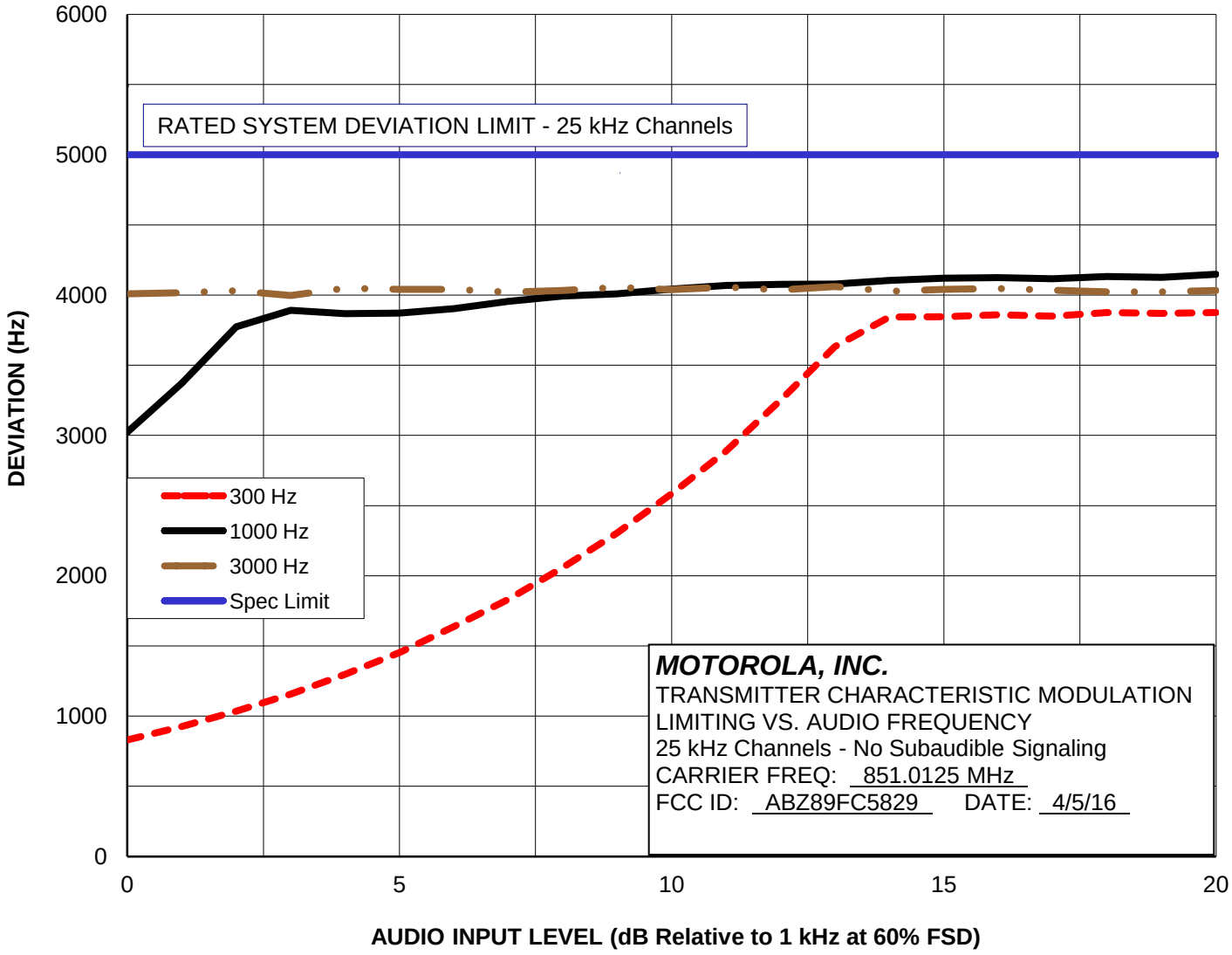
Modulation:	Audio Test Tone, Varying Frequency between 300 Hz and 3000 Hz
Carrier Frequency:	Performance was measured at carrier frequencies at the low end, middle, and high end of the 851-869 MHz operating band. For performance in the FCC NPSPAC band, a carrier frequency in the 851-854 MHz range was also measured.

Modulation Limiting Response Plots:

EXHIBIT	DESCRIPTION
E1-7.1	Audio Modulation Limiting – Modulation Characteristics, 25 kHz Channels – Low End of Band
E1-7.2	Audio Modulation Limiting – Modulation Characteristics, 25 kHz Channels – Middle of Band
E1-7.3	Audio Modulation Limiting – Modulation Characteristics, 25 kHz Channels – High End of Band
E1-7.4	Audio Modulation Limiting – Modulation Characteristics, 12.5 kHz Channels – Low End of Band
E1-7.5	Audio Modulation Limiting – Modulation Characteristics, 12.5 kHz Channels – Middle of Band
E1-7.6	Audio Modulation Limiting – Modulation Characteristics, 12.5 kHz Channels – High End of Band
E1-7.7	Audio Modulation Limiting – Modulation Characteristics, NPSPAC Channels

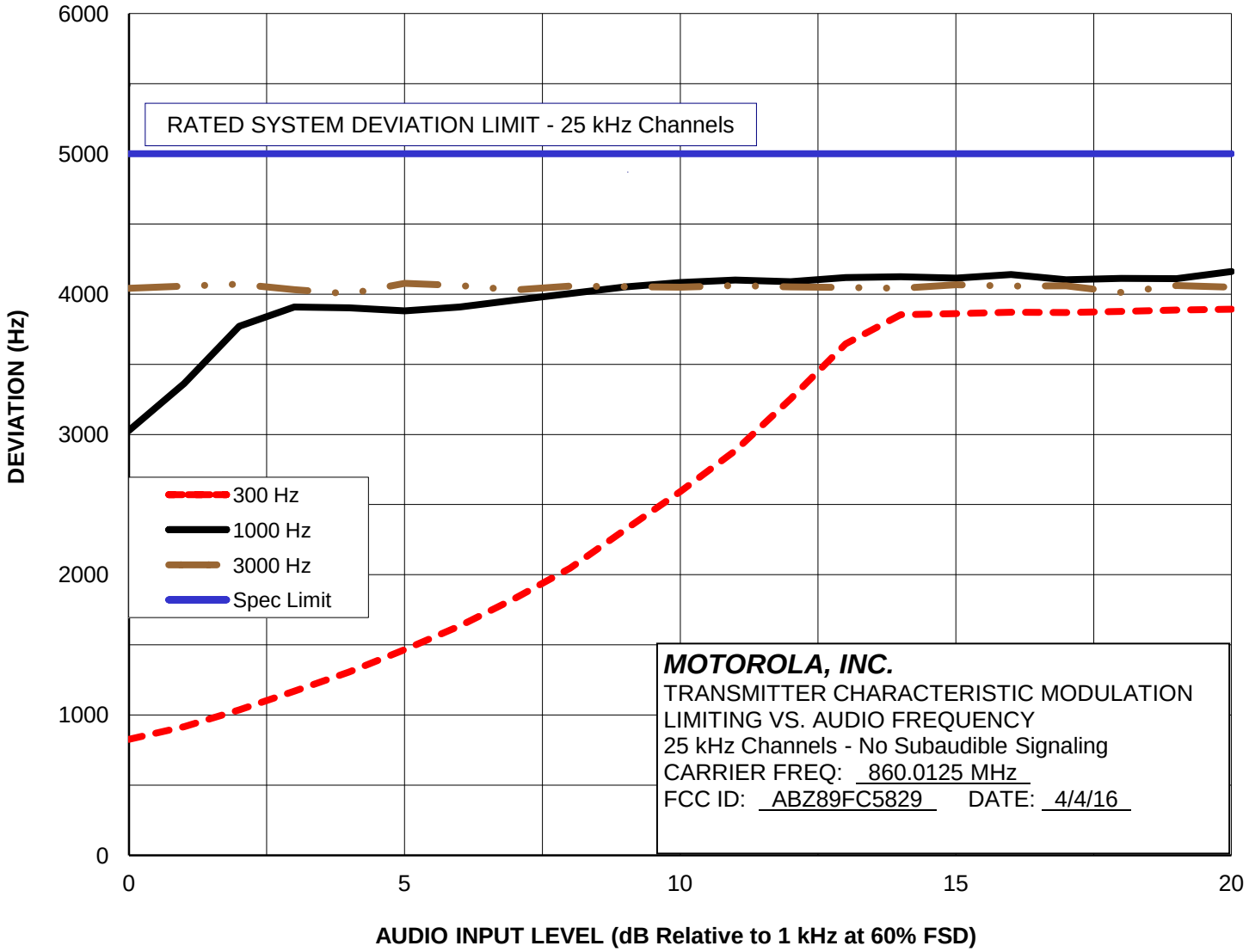
Report on Test Measurements

Modulation Limiting – 25 kHz Channels



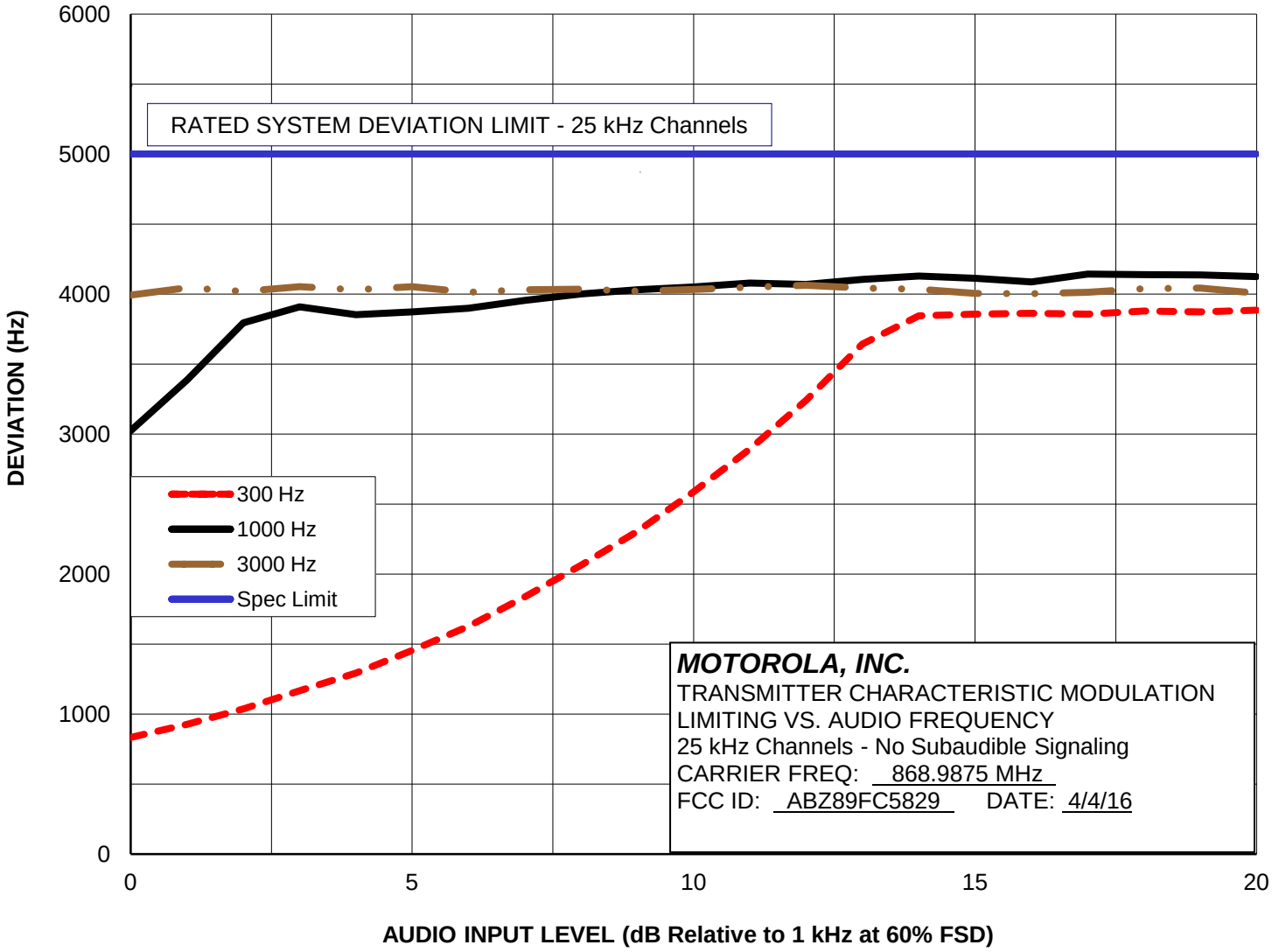
Report on Test Measurements

Modulation Limiting – 25 kHz Channels



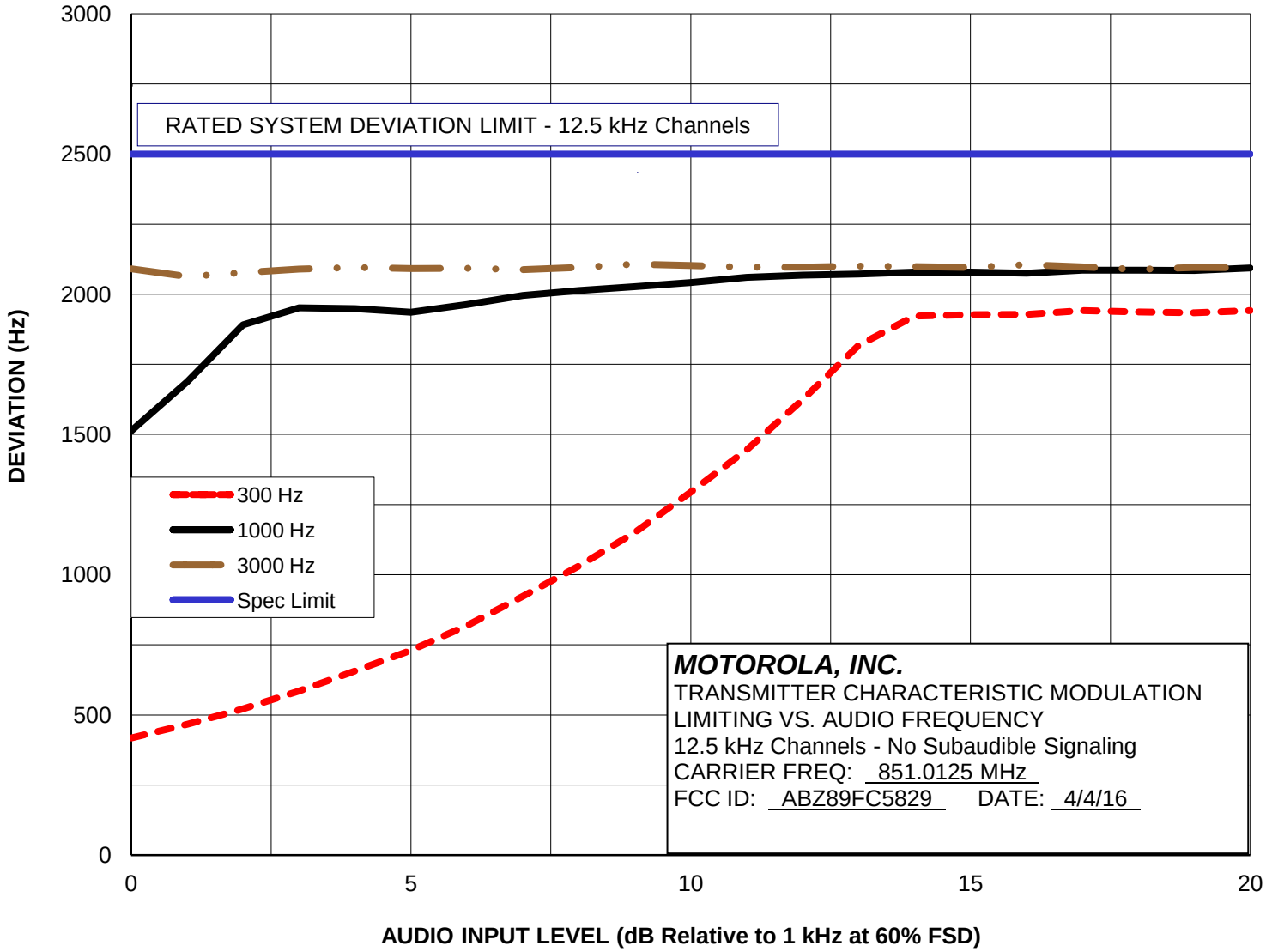
Report on Test Measurements

Modulation Limiting – 25 kHz Channels



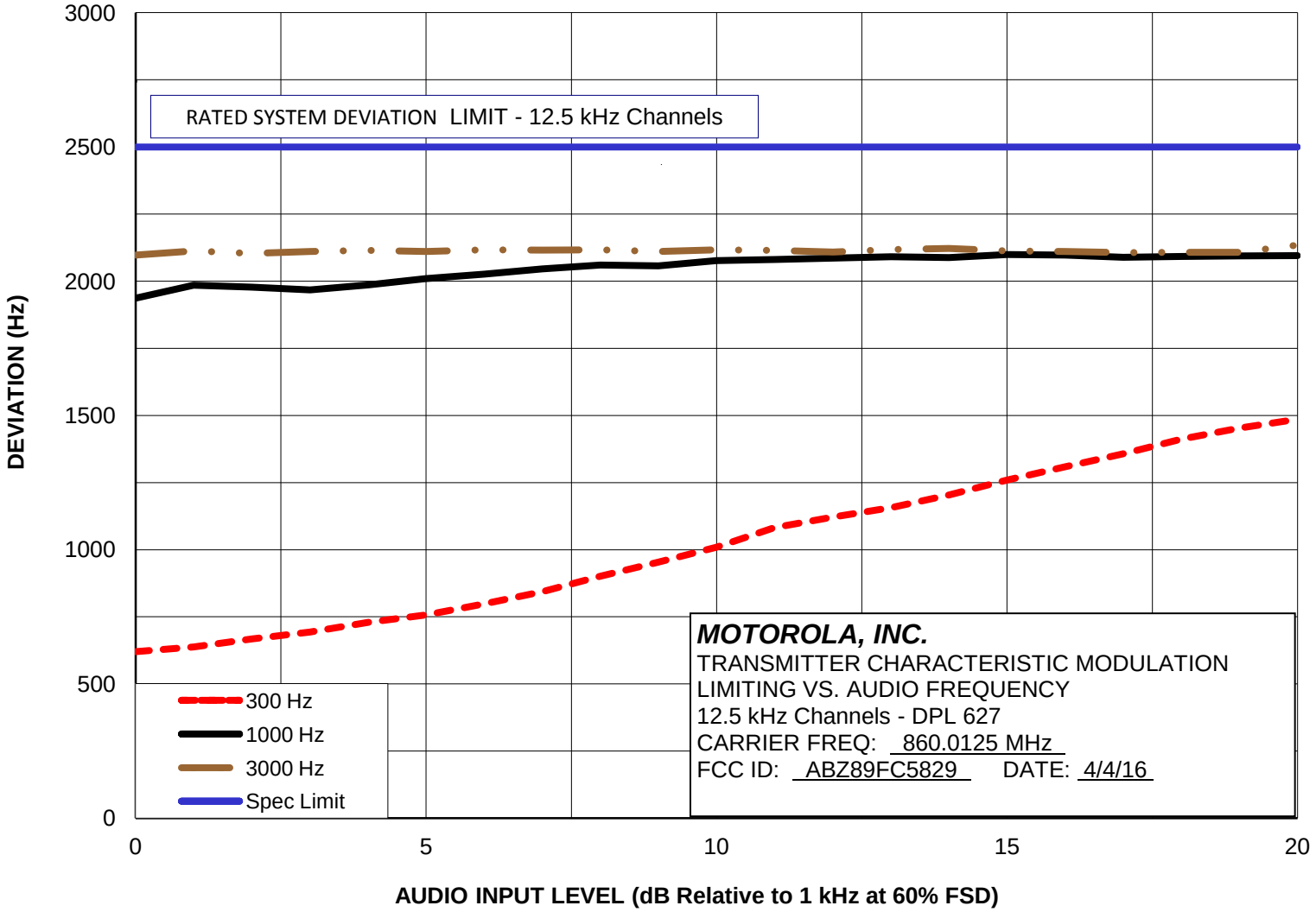
Report on Test Measurements

Modulation Limiting – 12.5 kHz Channels



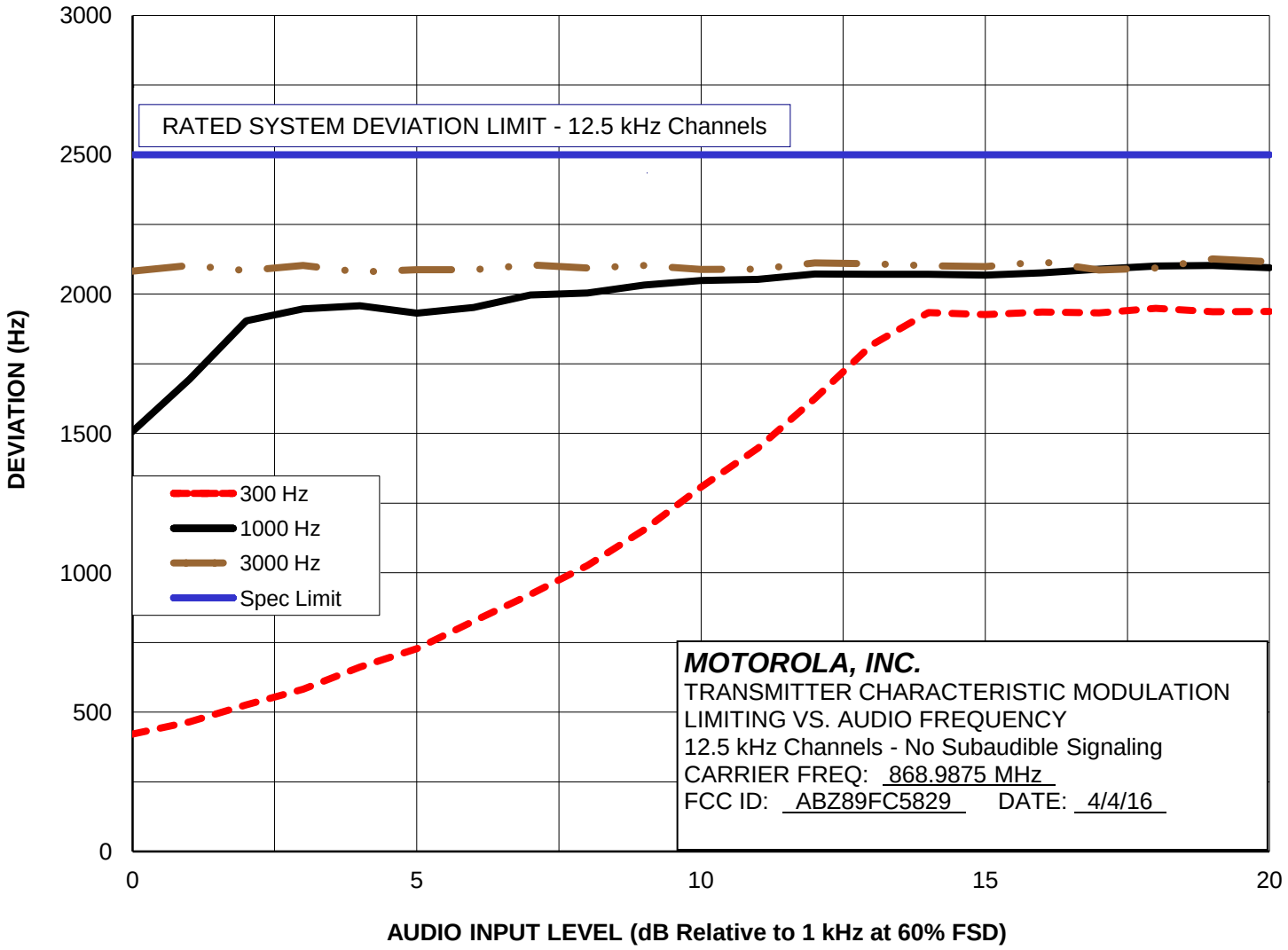
Report on Test Measurements

Modulation Limiting – 12.5 kHz Channels



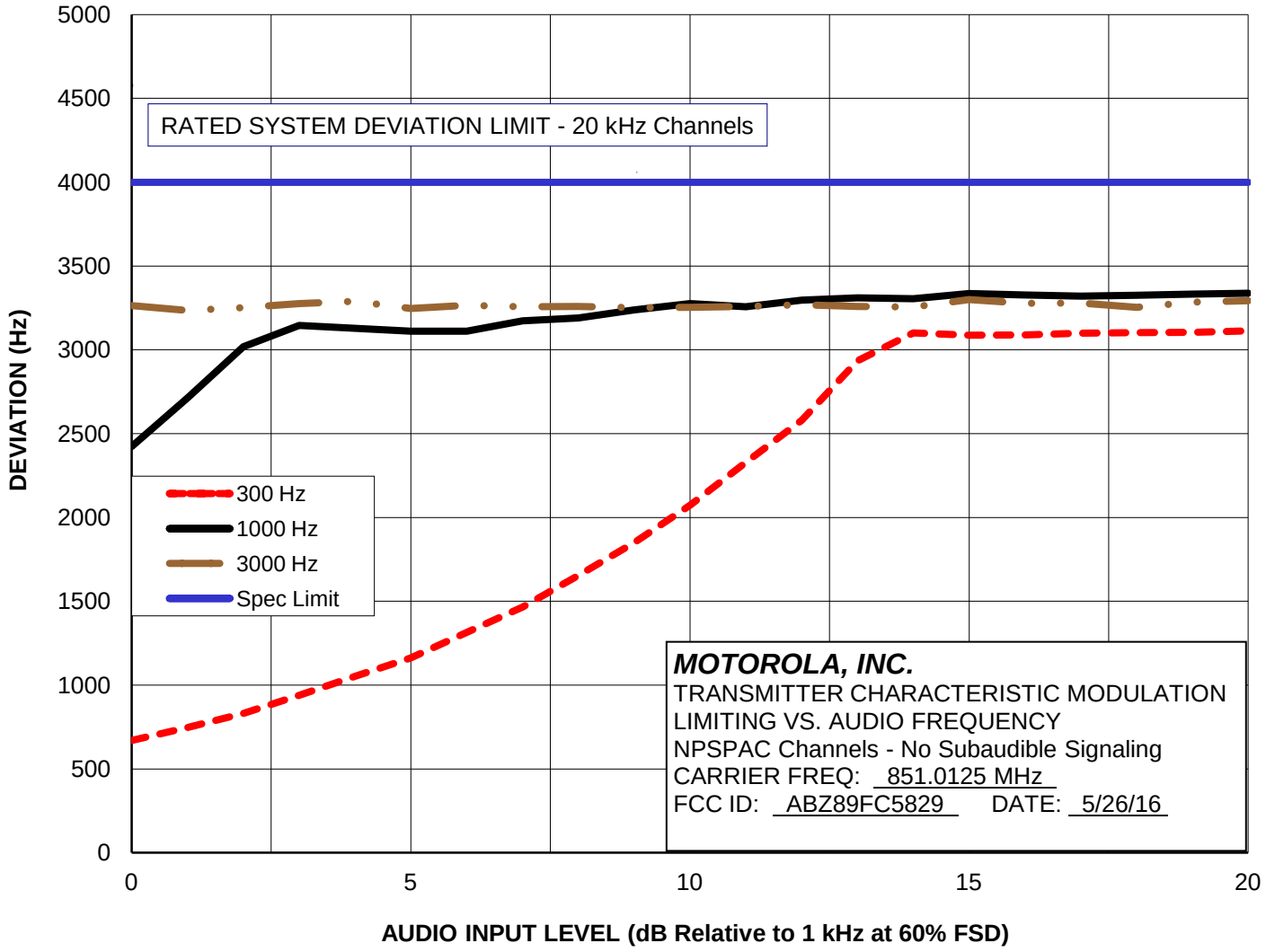
Report on Test Measurements

Modulation Limiting – 12.5 kHz Channels



Report on Test Measurements

Modulation Limiting – NPSPAC Channels



Report on Test Measurements

Occupied Bandwidth – Analog Voice Frequency Modulation, 25 kHz Channel Spacing
The exhibits in this section show occupied bandwidth plots for analog voice modulation. Data is shown with the modulating audio tone itself, the tone plus Private Line (PL) sub-audible tone signaling, and tone plus Digital Private Line (DPL) sub-audible signaling, 150 bps low speed data, and 300 bps low speed data. PL and DPL are used in "Conventional" systems, whereas 150 bps and 300 bps low speed data are used in "Trunking" systems.

The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type:	Analog Voice
Emission Designator:	16K0F3E
Channelization:	25 kHz
Deviation Limit:	±5.0 kHz Max
Power Setting:	33 Watts

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:
On any frequency removed from the assigned frequency by a displacement frequency (F_d in kHz) of:

a) >10 kHz up to and including 20 kHz — *At least 25 dB;*
b) >20 kHz up to and including 50 kHz — *At least 35 dB;*
c) >50 kHz — *at least 43+10 * Log_{10} (P) dB.*

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M	*Max Deviation, D*	*2*(M+D)*	*Nec BW*
3 kHz	5 kHz	16 kHz	16K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	300 Hz	Resolution BW:	300 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	7.4 ms

Test Procedure:

1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
2) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
4) Plot the resulting analyzer trace. The occupied bandwidth mask is then added along with additional labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW Low, Mid, High**
E1-8.1, 2, 3	Carrier with 2500 Hz Audio Tone, 25 kHz Channels	14.86, 14.85, 14.85 kHz
E1-8.4, 5, 6	Carrier, 2500 Hz Audio, Private Line (PL), 25 kHz Channels	11.58, 11.63, 11.66 kHz
E1-8.7, 8, 9	Carrier, 2500 Hz Audio, Digital Private Line (DPL), 25 kHz Channels	11.89, 11.89, 11.91 kHz
E1-8.10, 11, 12	Carrier, 2500 Hz Audio, 150 bps Low Speed Data, 25 kHz Channels	11.83, 11.81, 11.81 kHz
E1-8.13, 14, 15	Carrier, 2500 Hz Audio, 300 bps Low Speed Data, 25 kHz Channels	11.58, 11.70, 11.70 kHz

Report on Test Measurements

Occupied Bandwidth – Analog Voice Frequency Modulation, 12.5 kHz Channel Spacing
The exhibits in this section show occupied bandwidth plots for analog voice modulation. Data is shown with the modulating audio tone itself, the tone plus Private Line (PL) sub-audible tone signaling, and tone plus Digital Private Line (DPL) sub-audible signaling, 150 bps low speed data, and 300 bps low speed data. PL and DPL are used in "Conventional" systems, whereas 150 bps and 300 bps low speed data are used in "Trunking" systems.

The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type:	Analog Voice
Emission Designator:	11K0F3E
Channelization:	12.5 kHz
Deviation Limit:	±2.5 kHz Max
Power Setting:	33 Watts

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth (f_0) to 5.625 kHz removed from f_0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to ensure that the emission profile is developed.

Necessary Bandwidth Calculation (Analog Emission):
The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

Max Mod Freq, M	*Max Deviation, D*	*2*(M+D)*	*Nec BW*
3 kHz	2.5 kHz	11 kHz	11K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz	Resolution BW:	150 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	15 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	14.8 ms

(continued next page)

Report on Test Measurements

Occupied Bandwidth –12.5 kHz Channel Spacing (continued)

Test Procedure (Analog Voice):

1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
2) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
4) Plot the resulting analyzer trace. The occupied bandwidth mask is then added along with additional labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	DESCRIPTION	Meas Occ BW Low, Mid, High
E1-8.16,17,18	Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels	9.97, 9.97, 9.97 kHz
E1-8.19,20,21	Carrier, 2500 Hz Audio, Private Line (PL), 12.5 kHz Channels	6.03, 6.04, 6.04 kHz
E1-8.22,23,24	Carrier, 2500 Hz Audio, Digital Private Line (DPL), 12.5 kHz Channels	6.00, 6.00, 6.00 kHz
E1-8.25,26,27	Carrier, 2500 Hz Audio, 150 bps Low Speed Data, 12.5 kHz Channels	5.98, 5.98, 5.98 kHz
E1-8.28,29,30	Carrier, 2500 Hz Audio, 300 bps Low Speed Data, 12.5 kHz Channels	5.99, 5.98, 5.99 kHz

Report on Test Measurements

Occupied Bandwidth – Analog Voice Frequency Modulation, NPSPAC Channels
The exhibits in this section show occupied bandwidth plots for analog voice modulation. Data is shown with the modulating audio tone itself, the tone plus Private Line (PL) sub-audible tone signaling, and tone plus Digital Private Line (DPL) sub-audible signaling, 150 bps low speed data, and 300 bps low speed data. PL and DPL are used in "Conventional" systems, whereas 150 bps and 300 bps low speed data are used in "Trunking" systems.

The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type:	Analog Voice
Emission Designator:	14K0F3E
Channelization:	20 kHz
Deviation Limit:	±4.0 kHz Max
Power Setting:	33 Watts

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:
On any frequency removed from the assigned frequency by a displacement frequency (F_d in kHz) of:

a) >10 kHz up to and including 20 kHz — *At least 25 dB;*
b) >20 kHz up to and including 50 kHz — *At least 35 dB;*
c) >50 kHz — *at least 43+10 * Log_{10} (P) dB.*

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M	*Max Deviation, D*	*2*(M+D)*	*Nec BW*
3 kHz	4 kHz	14 kHz	14K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	300 Hz	Resolution BW:	300 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	7.4 ms

Test Procedure:

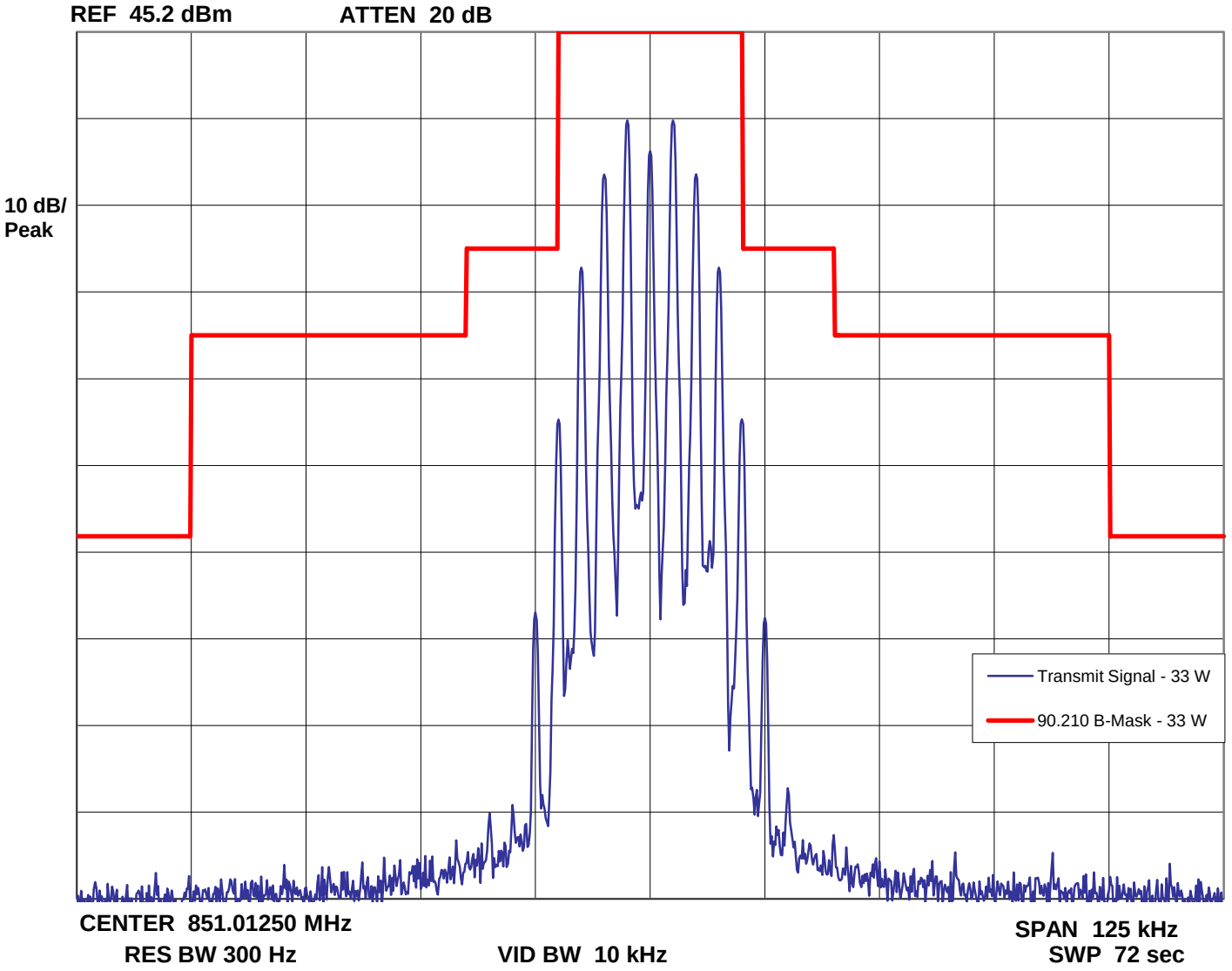
1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
2) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
4) Plot the resulting analyzer trace. The occupied bandwidth mask is then added along with additional labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW Low, Mid, High**
E1-8.31	Carrier with 2500 Hz Audio Tone, NPSPAC Channels	14.86 kHz
E1-8.32	Carrier, 2500 Hz Audio, Private Line (PL), NPSPAC Channels	11.69 kHz
E1-8.33	Carrier, 2500 Hz Audio, Digital Private Line (DPL), NPSPAC Channels	11.91 kHz
E1-8.34	Carrier, 2500 Hz Audio, 150 bps Low Speed Data, NPSPAC Channels	11.84 kHz
E1-8.35	Carrier, 2500 Hz Audio, 300 bps Low Speed Data, NPSPAC Channels	11.70 kHz

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

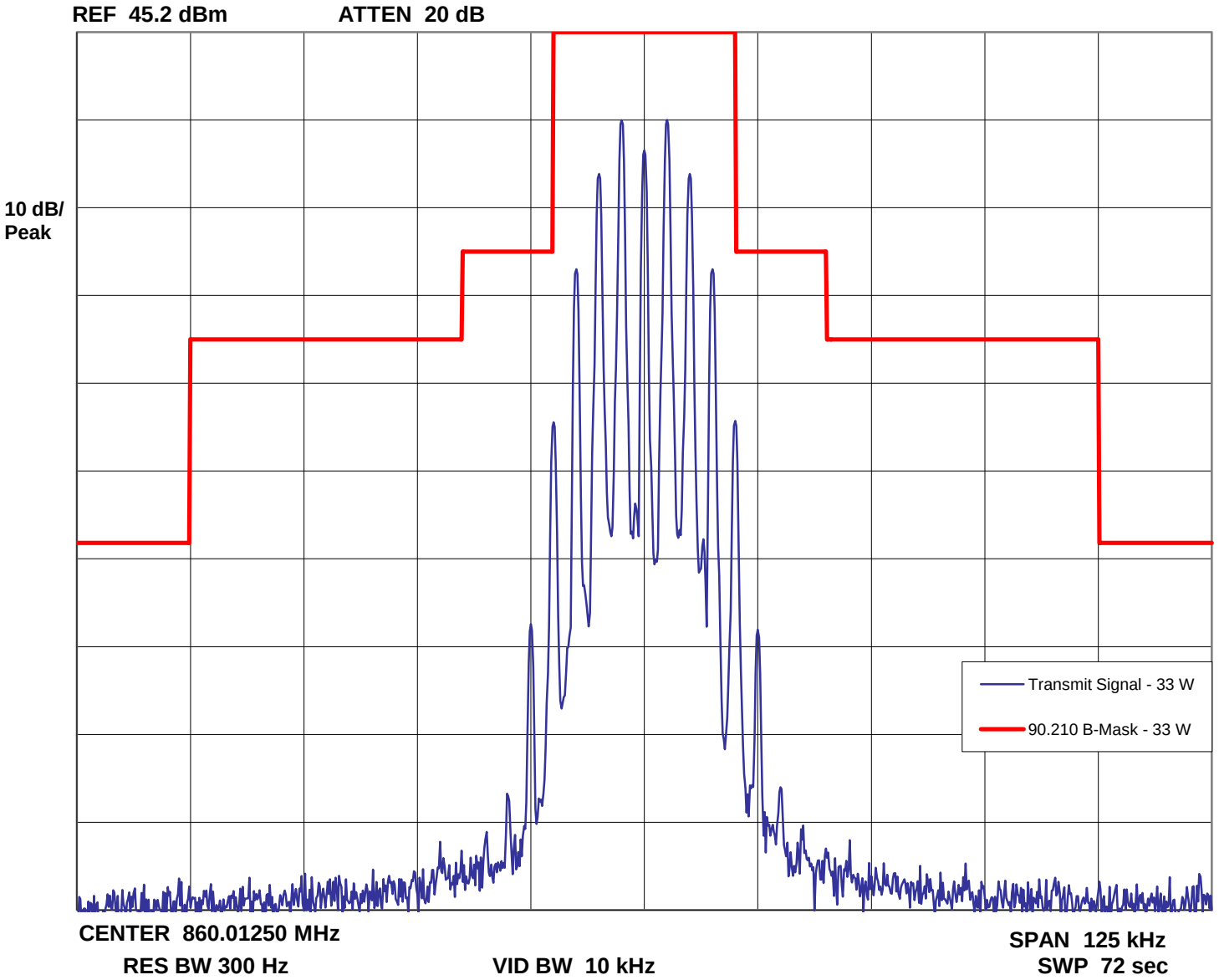
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier Carrier with 2500 Hz Audio Tone, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

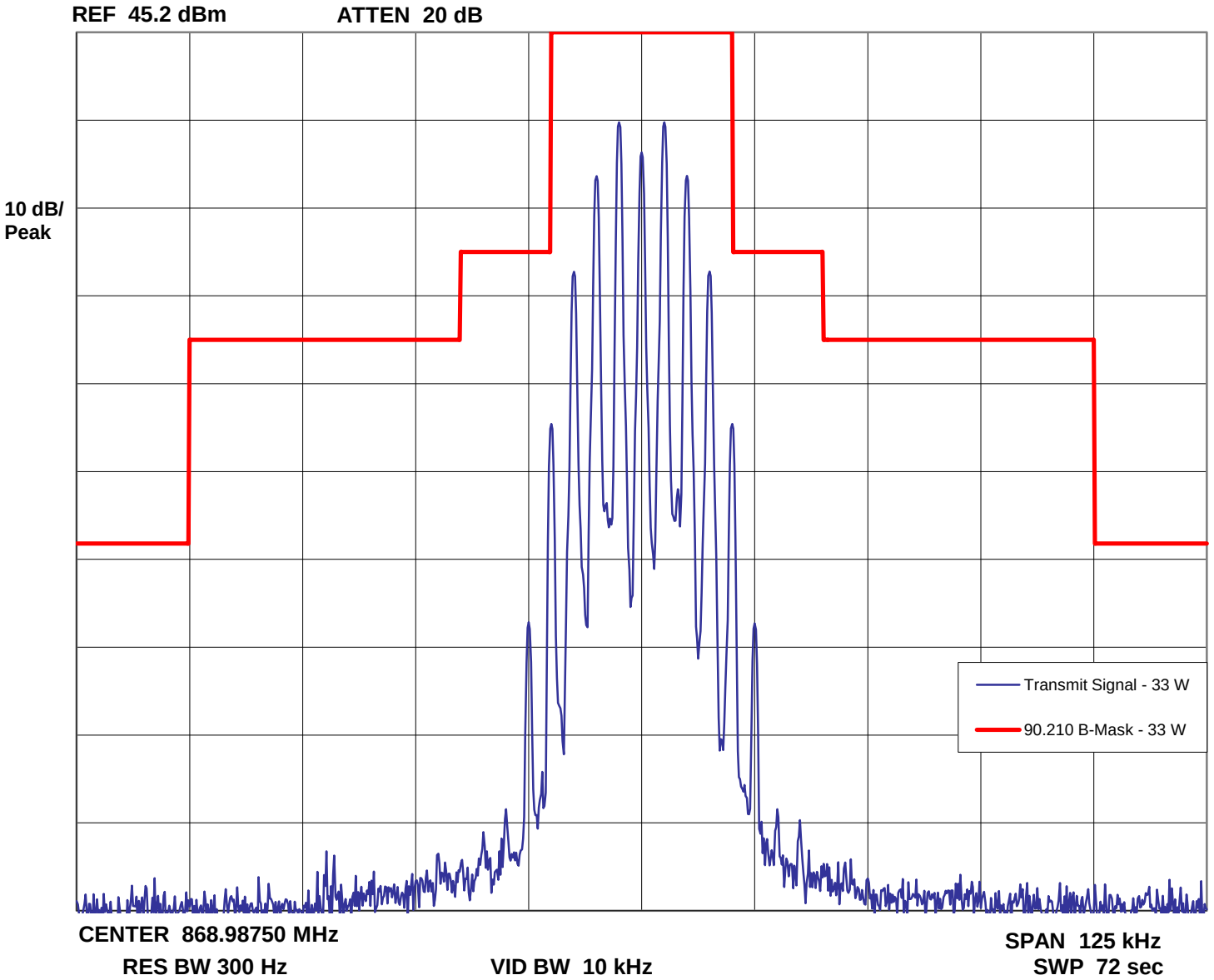
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

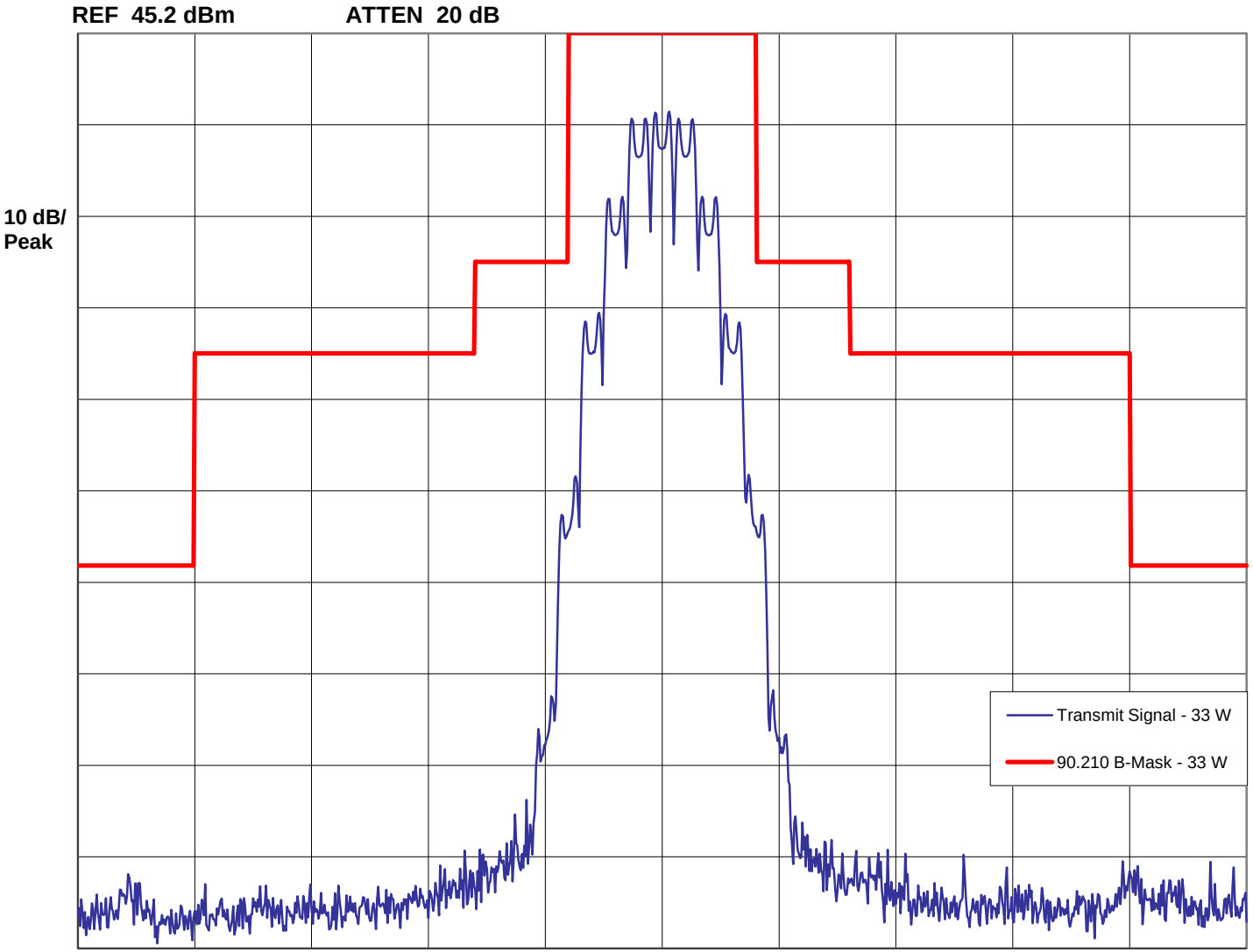
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

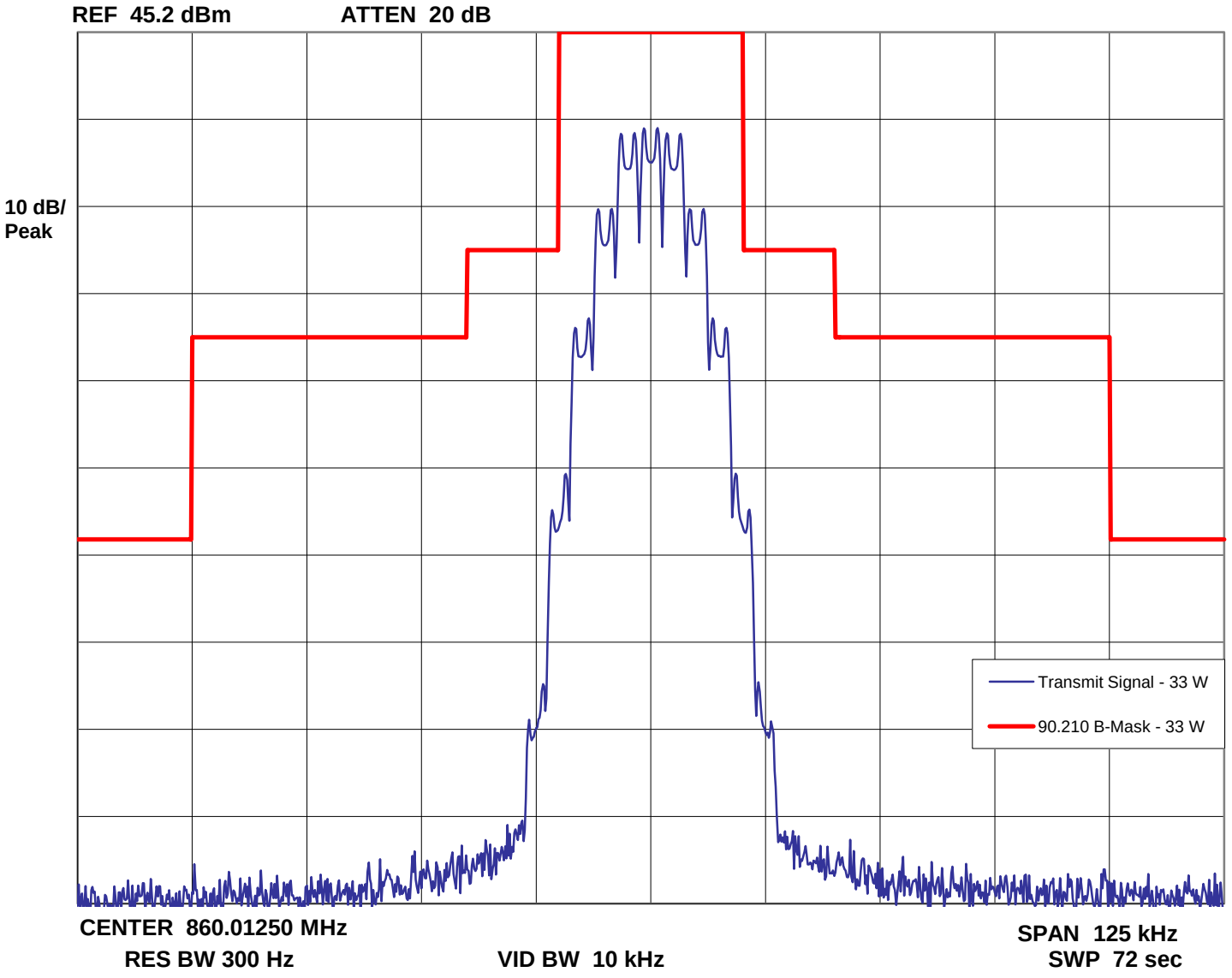
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

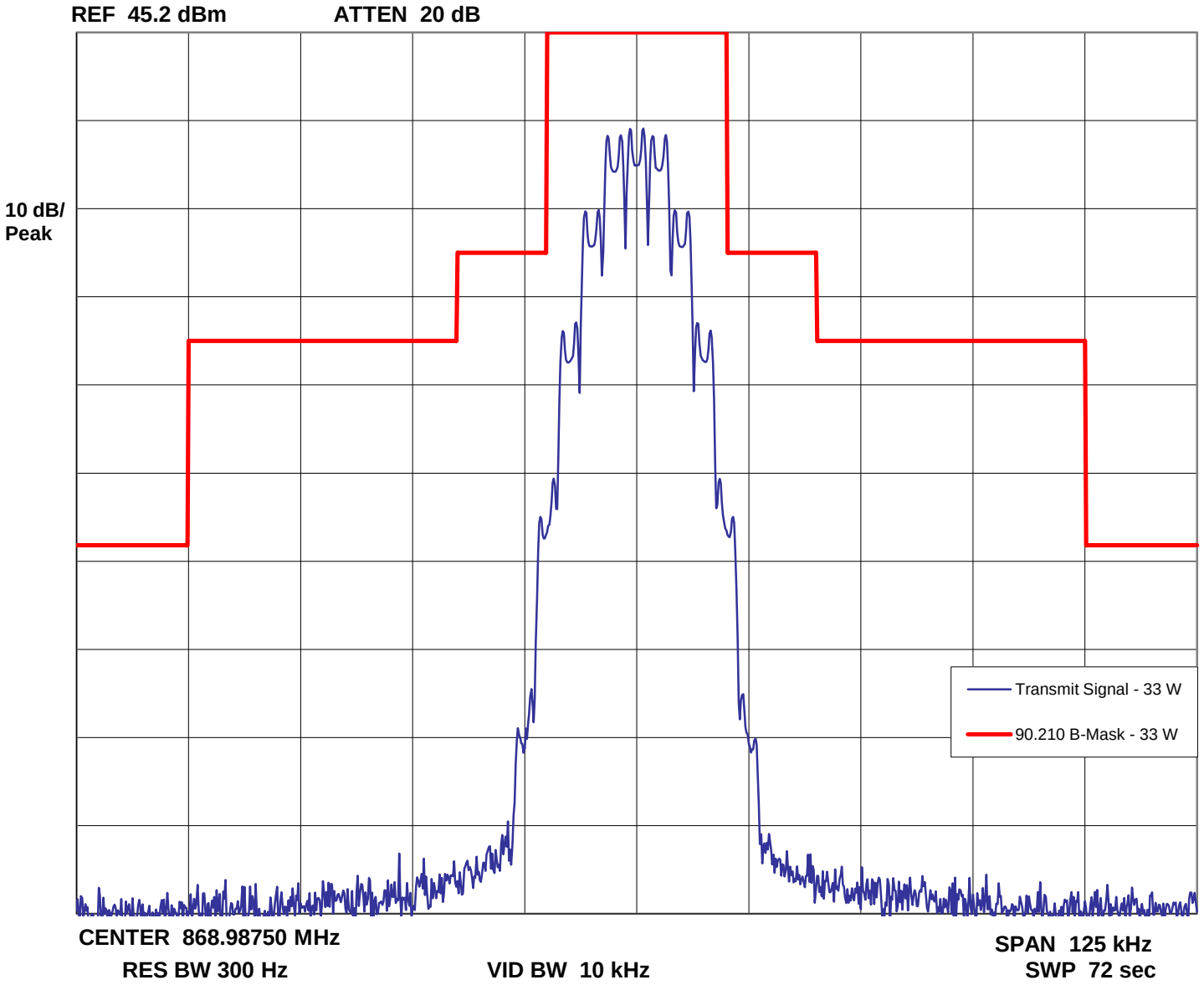
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

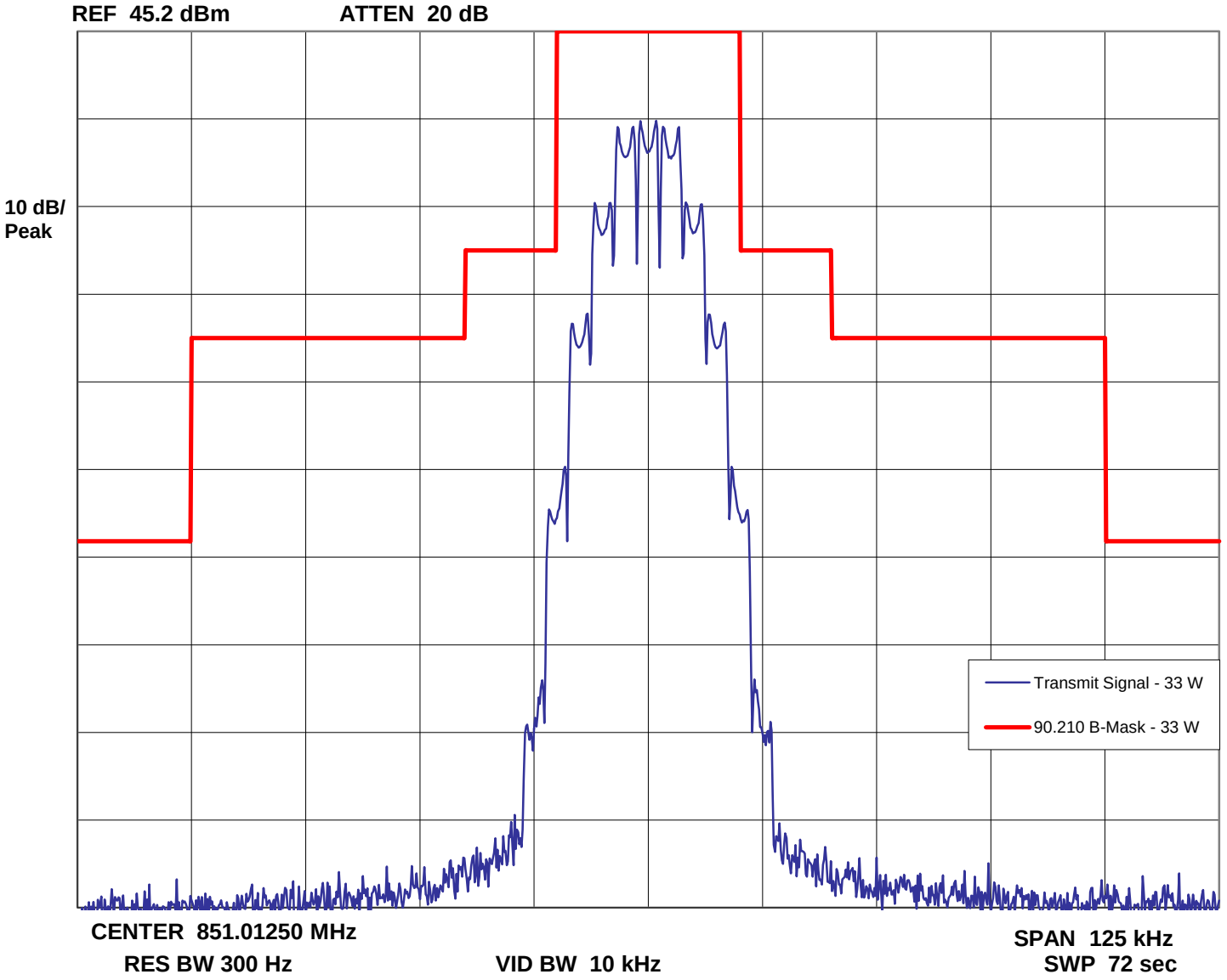
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and Digital Private Line (DPL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

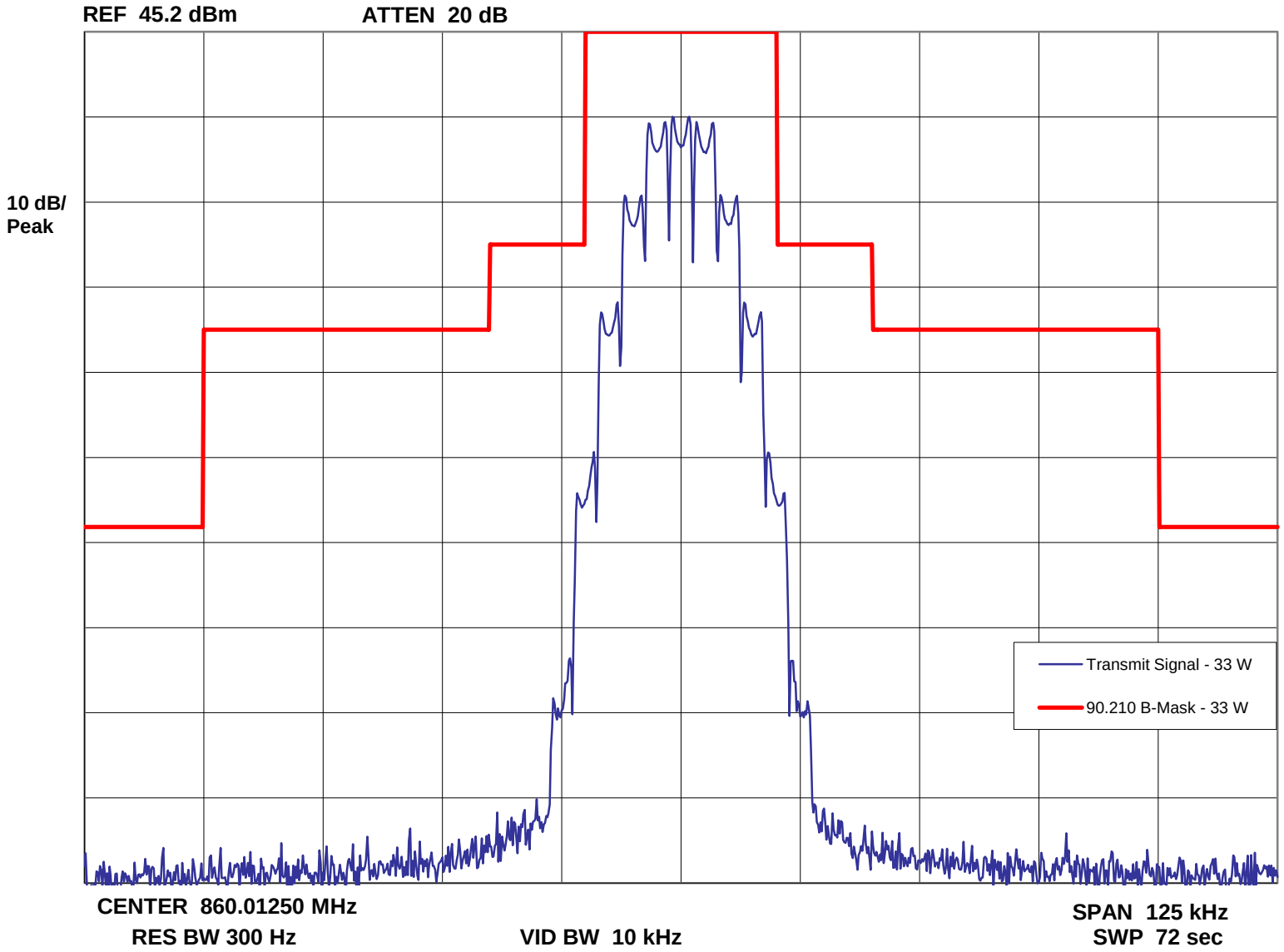
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and Digital Private Line (DPL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

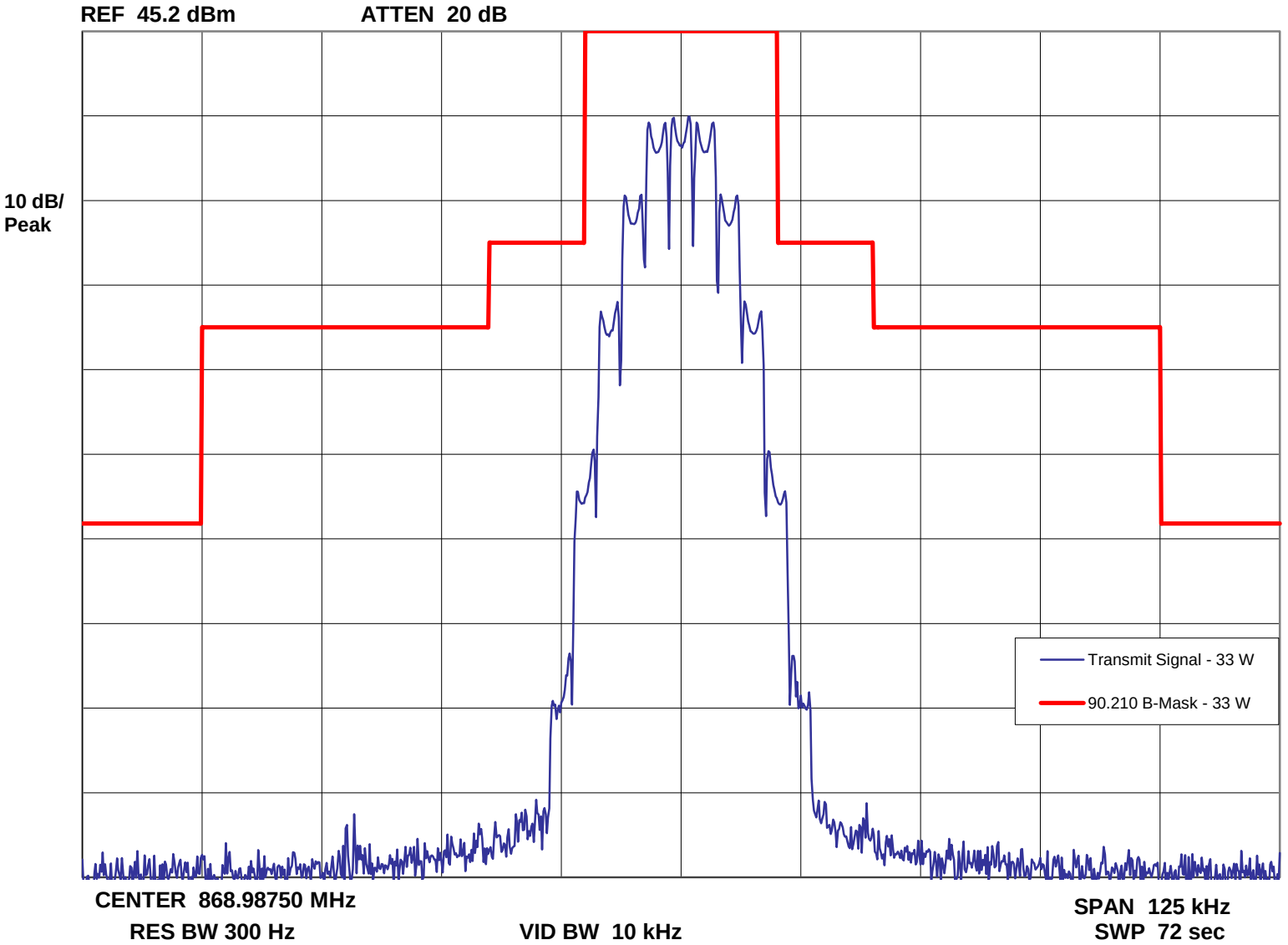
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and Digital Private Line (DPL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

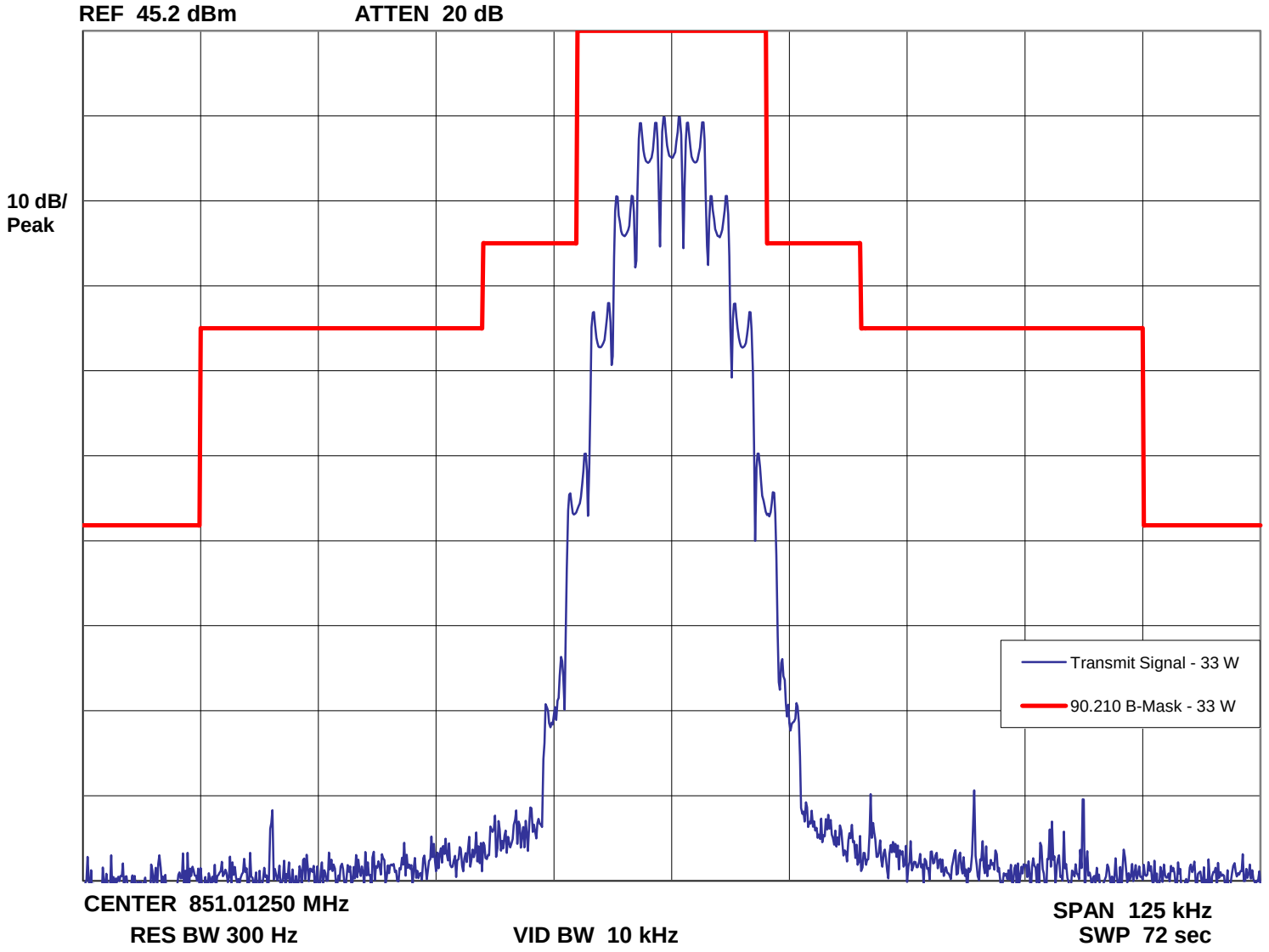
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 150 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

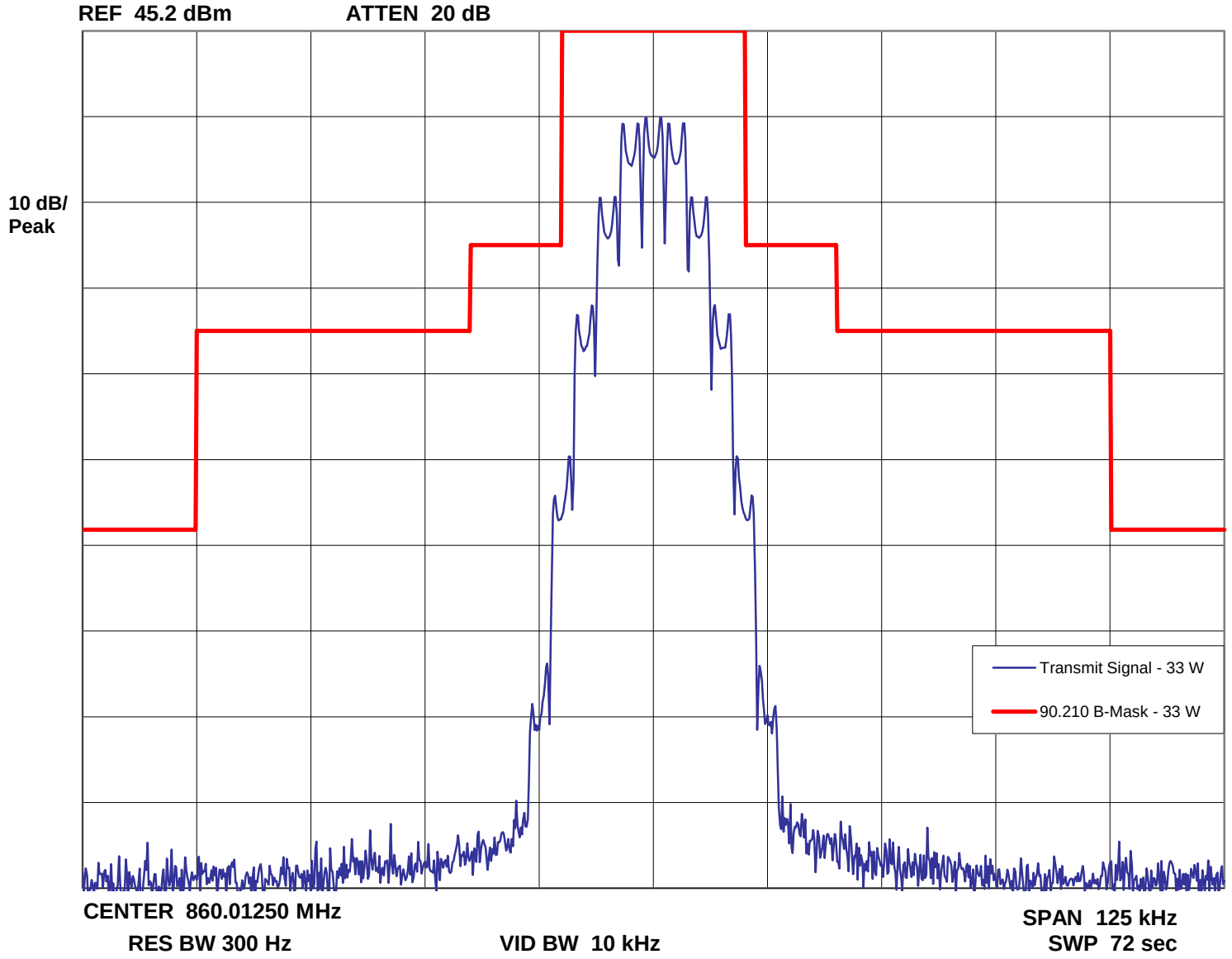
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 150 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

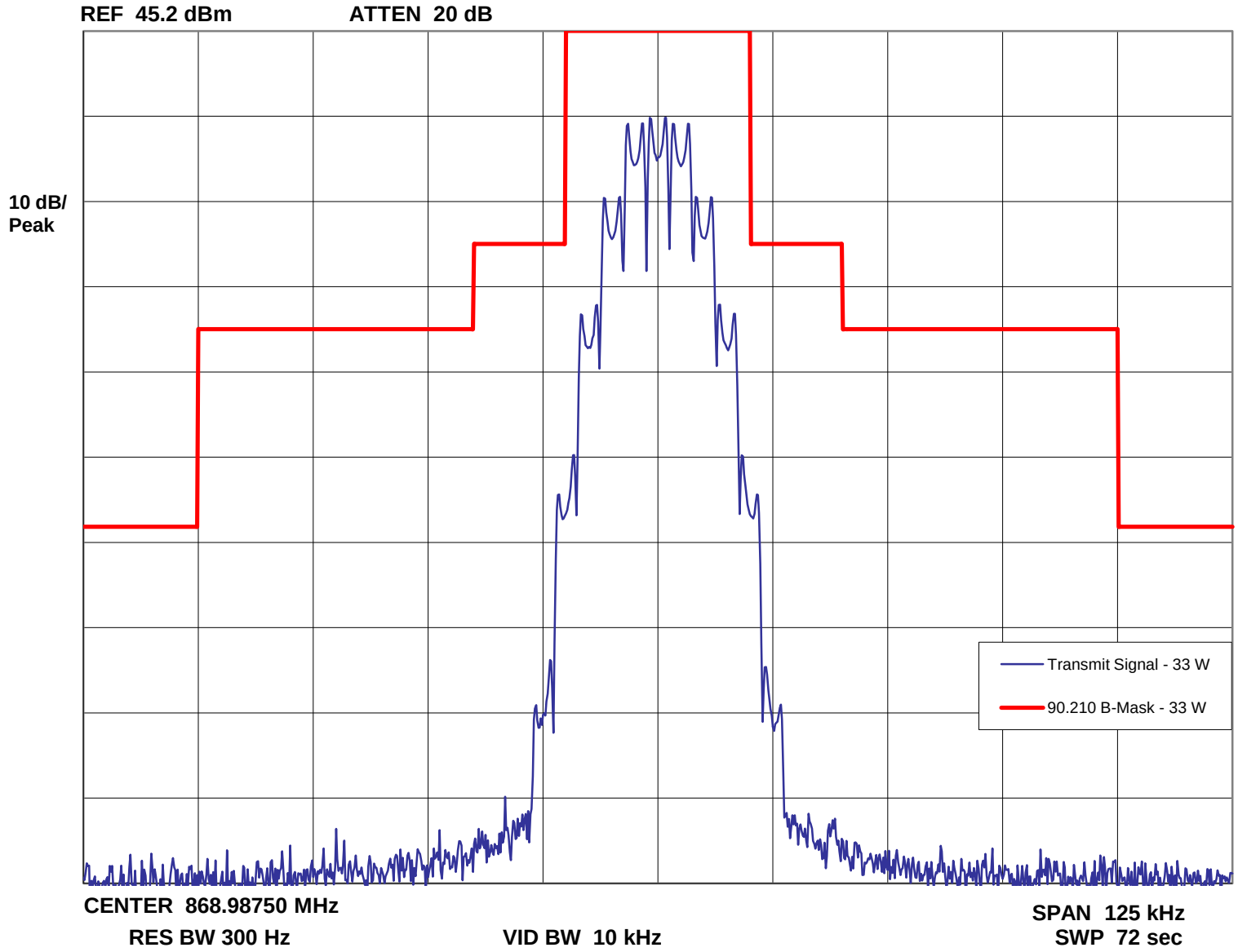
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 150 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

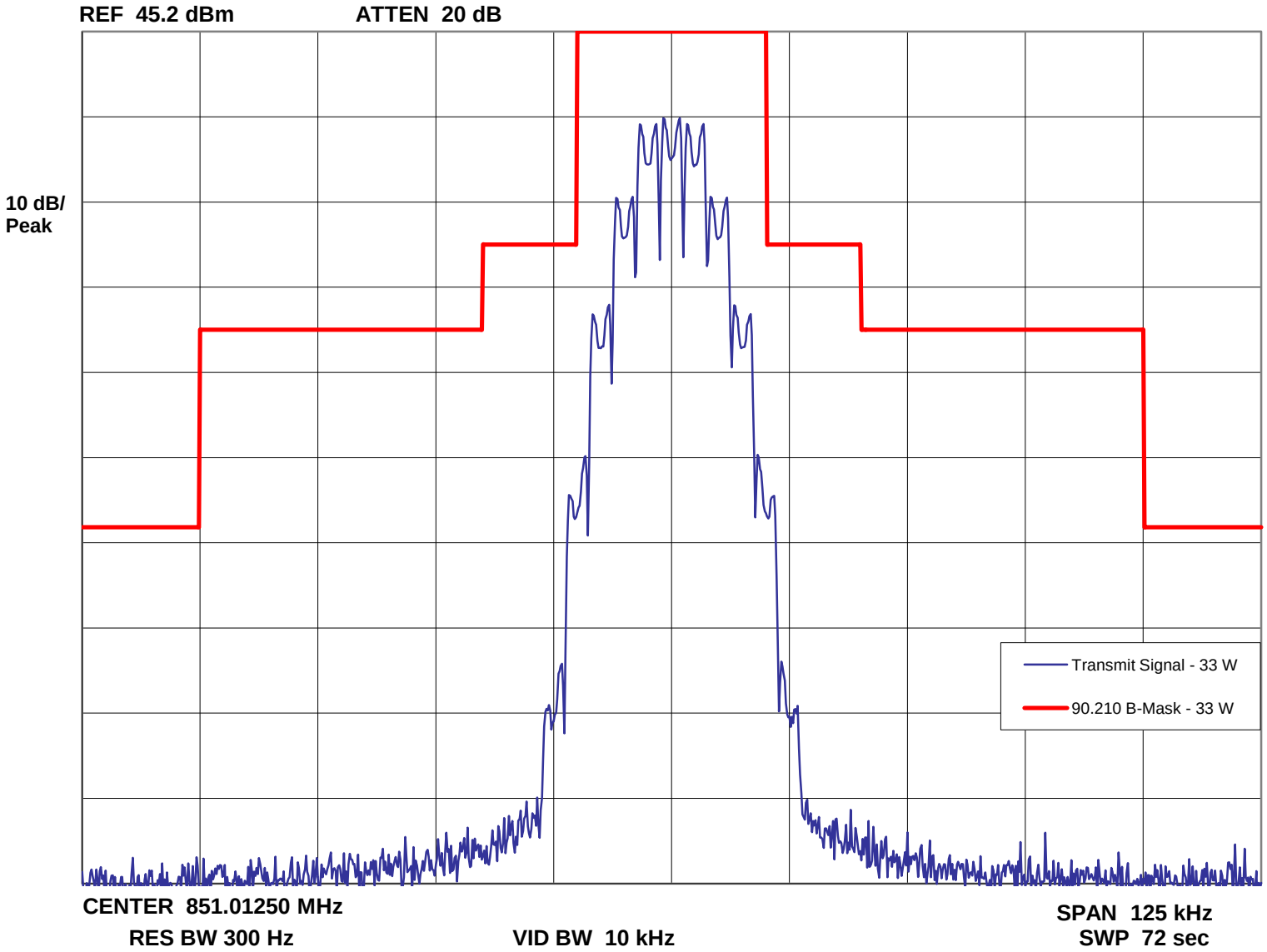
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 300 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

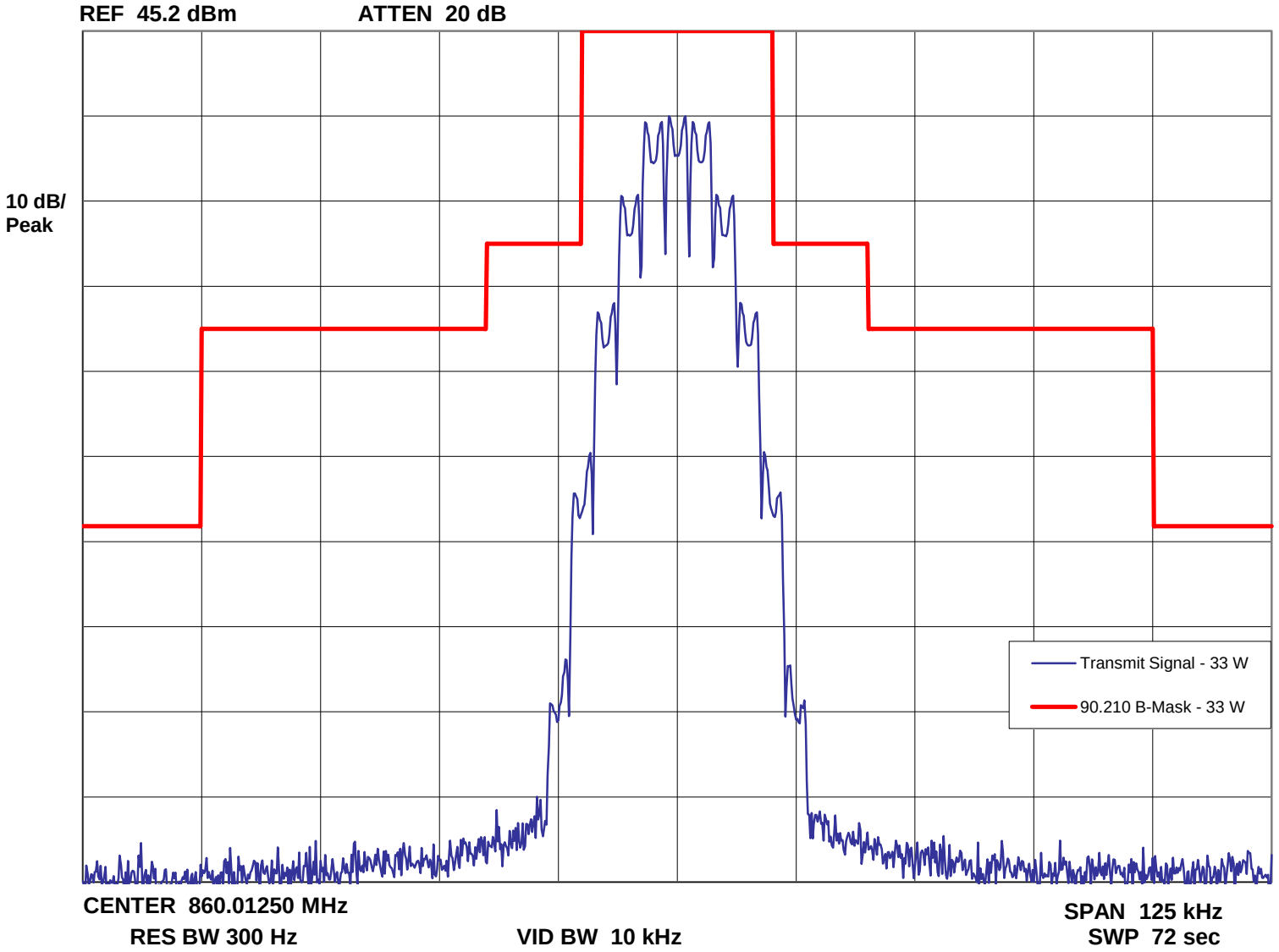
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 300 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

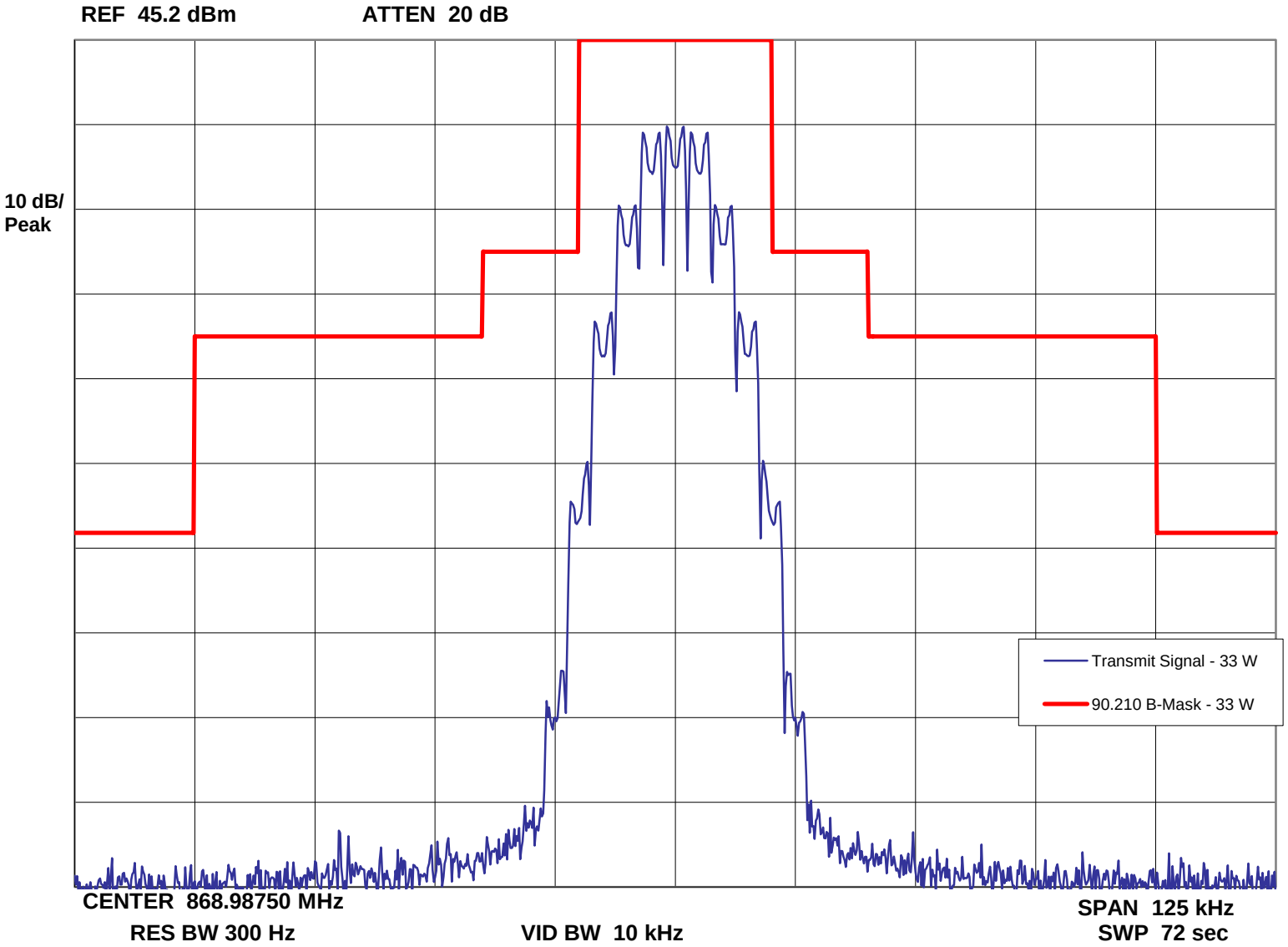
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 300 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

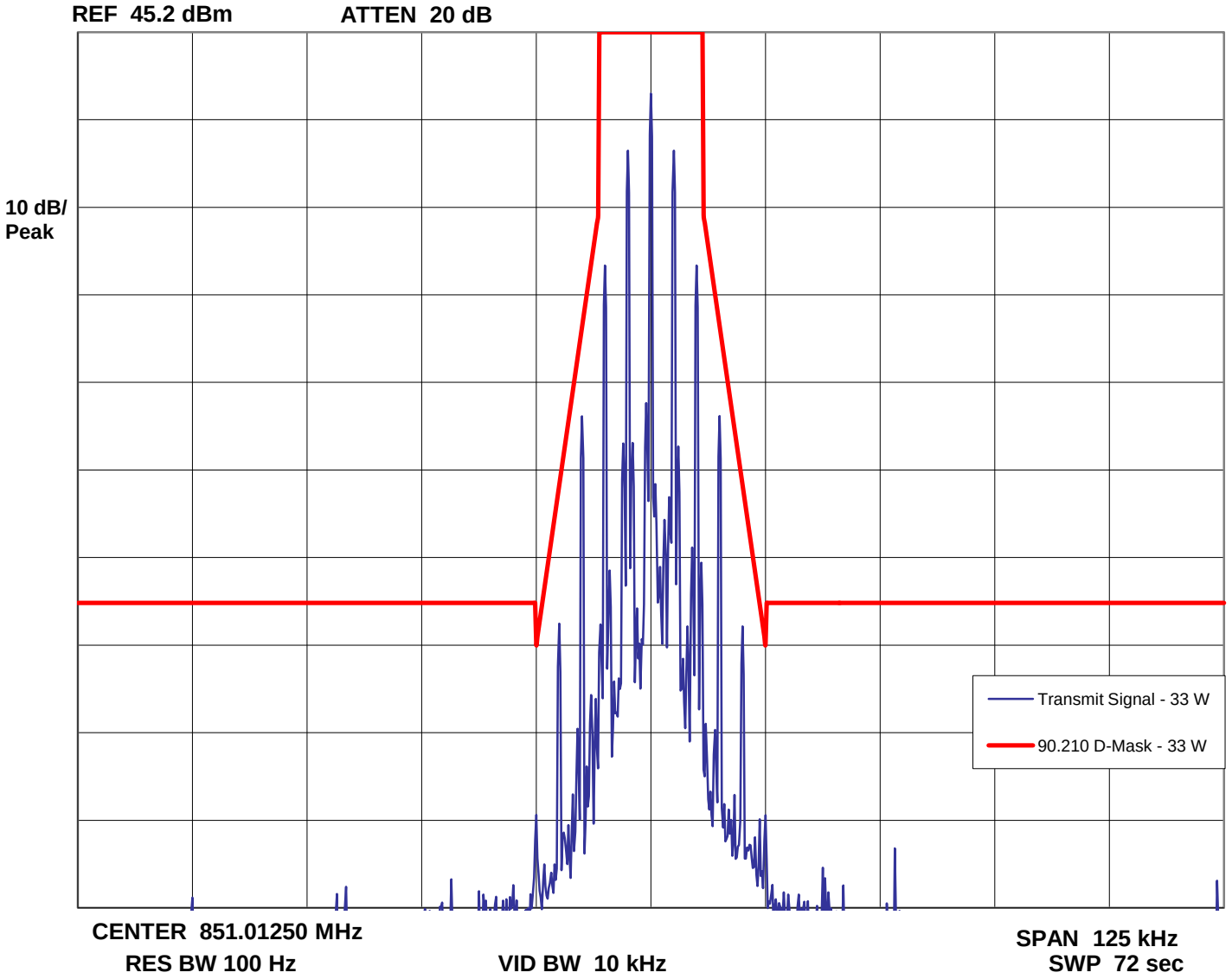
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

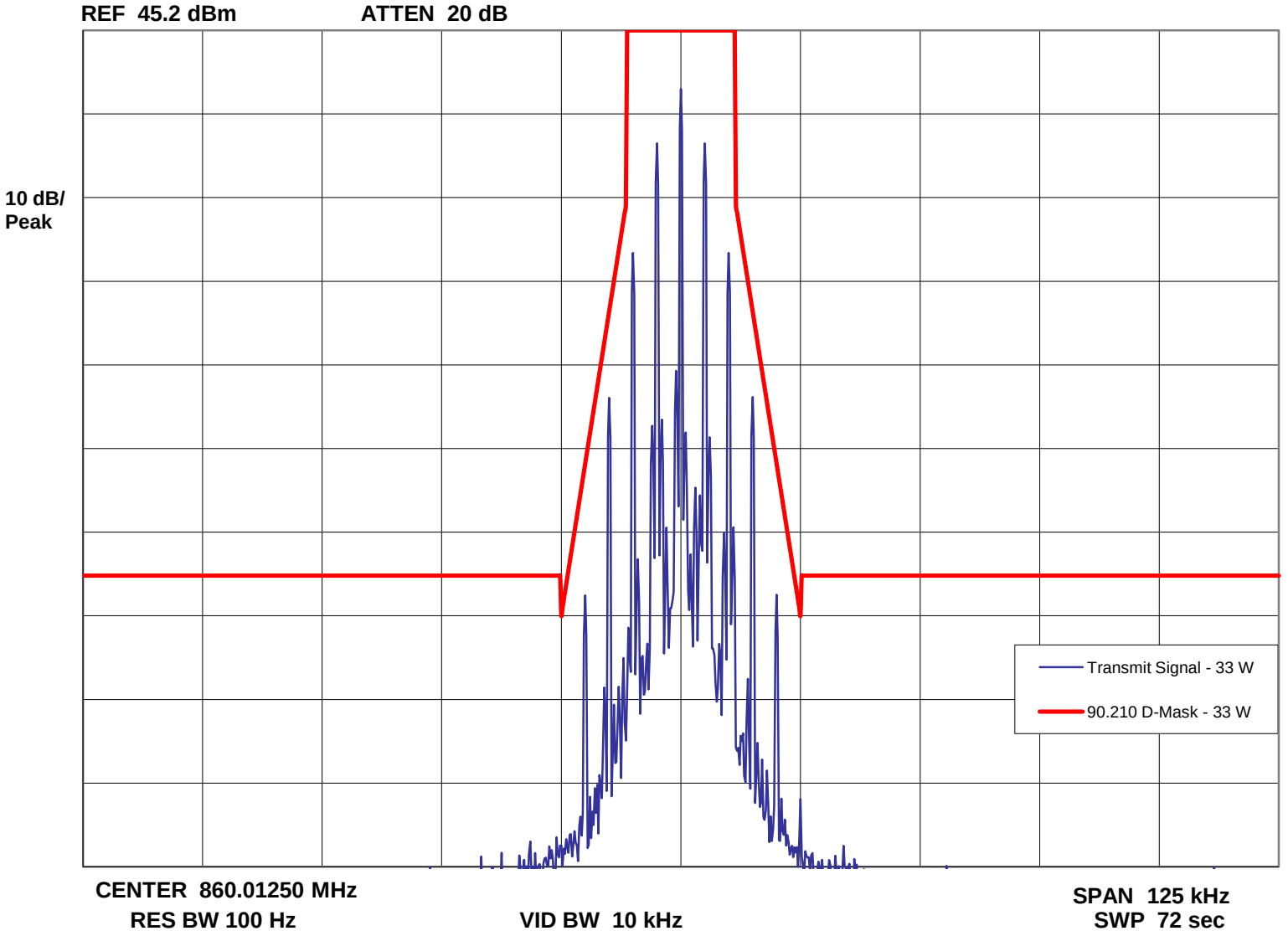
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

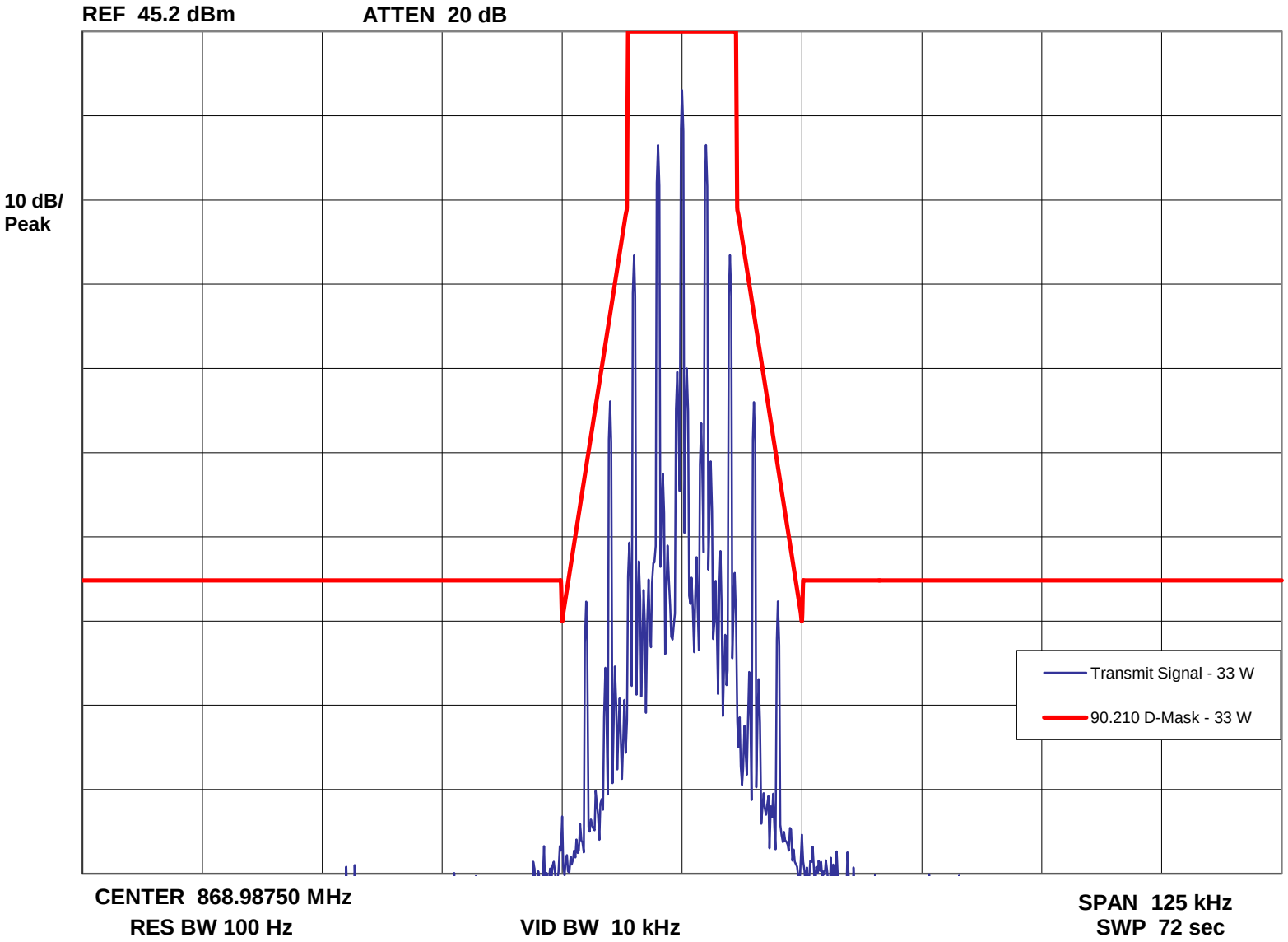
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

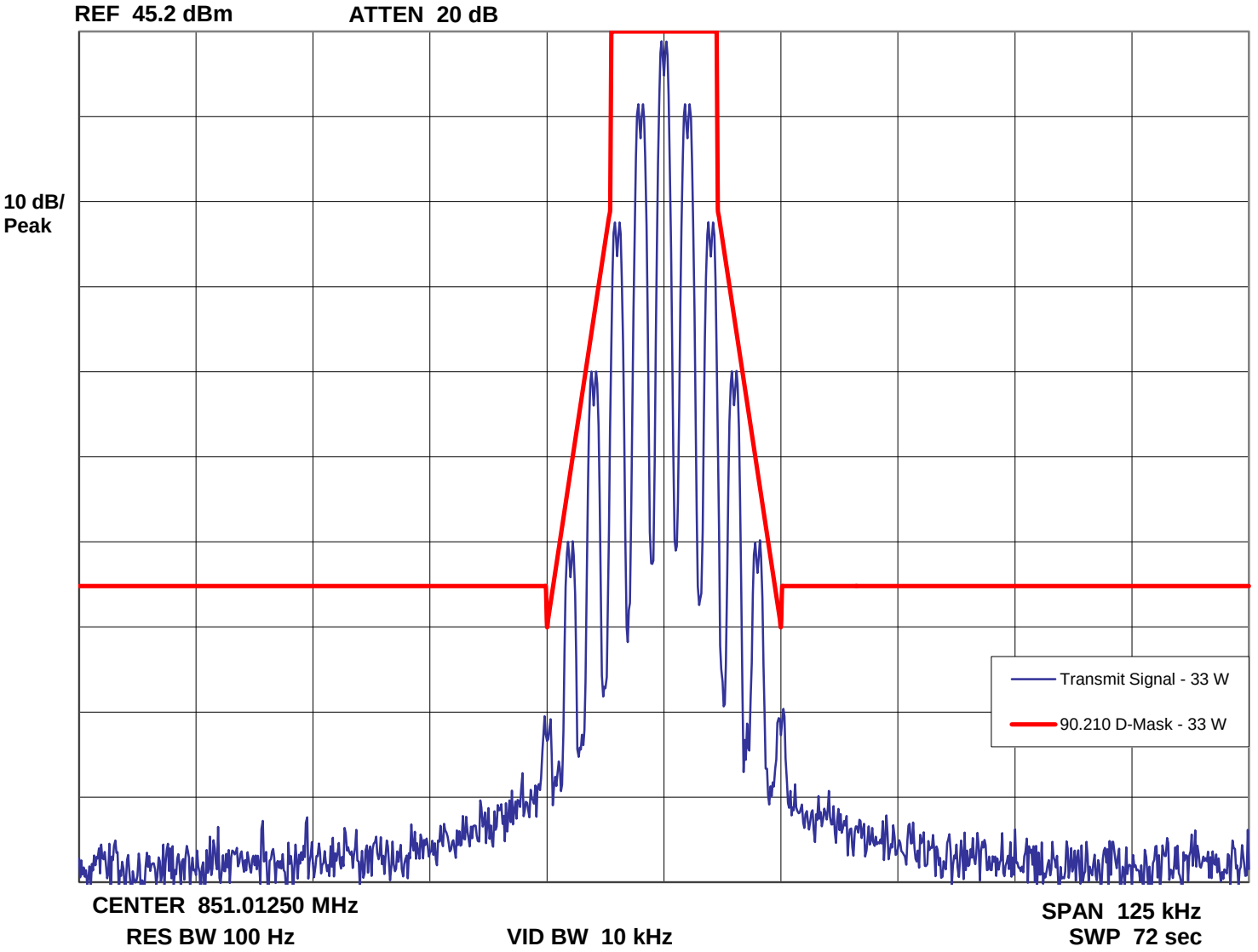
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

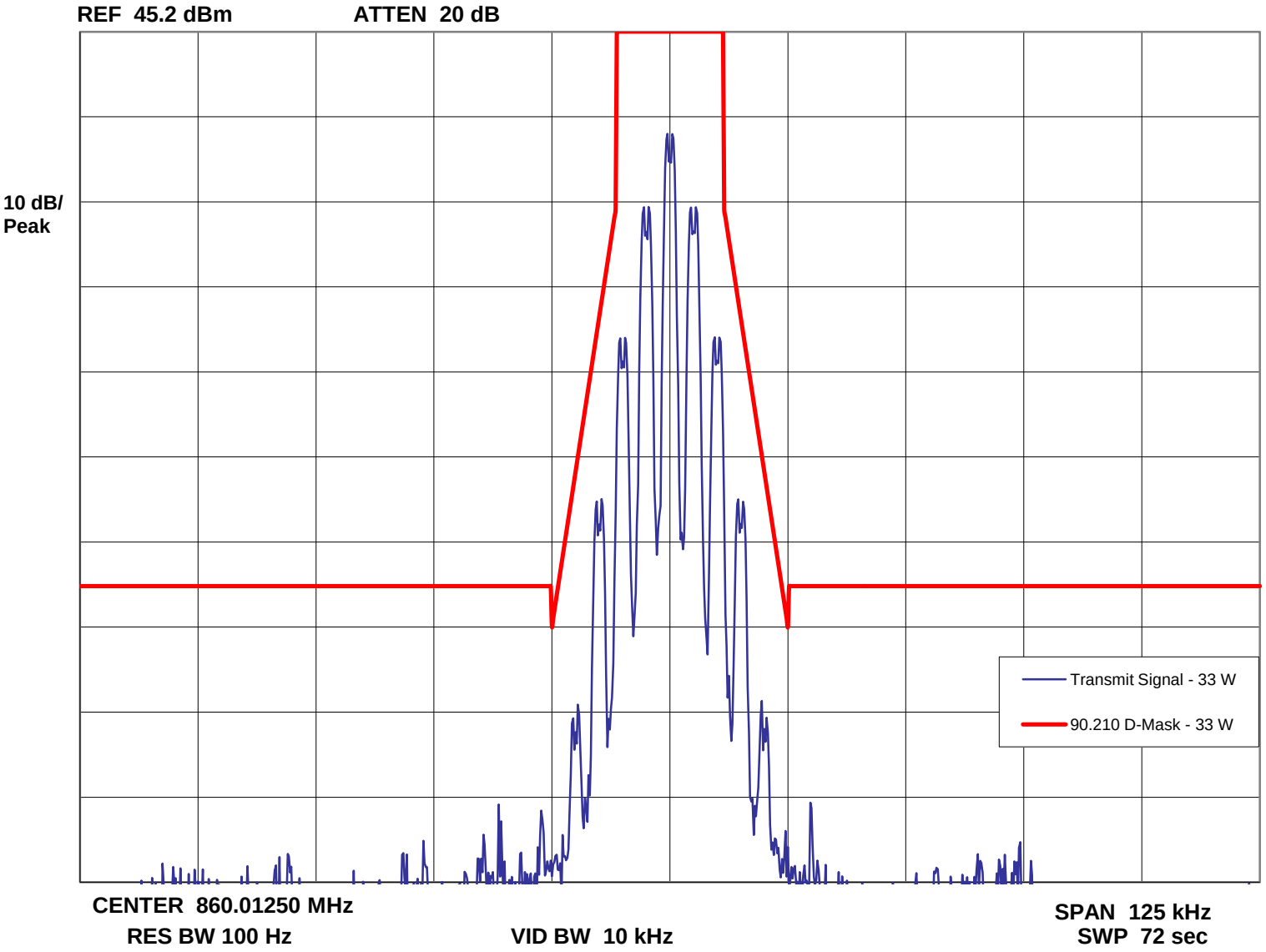
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

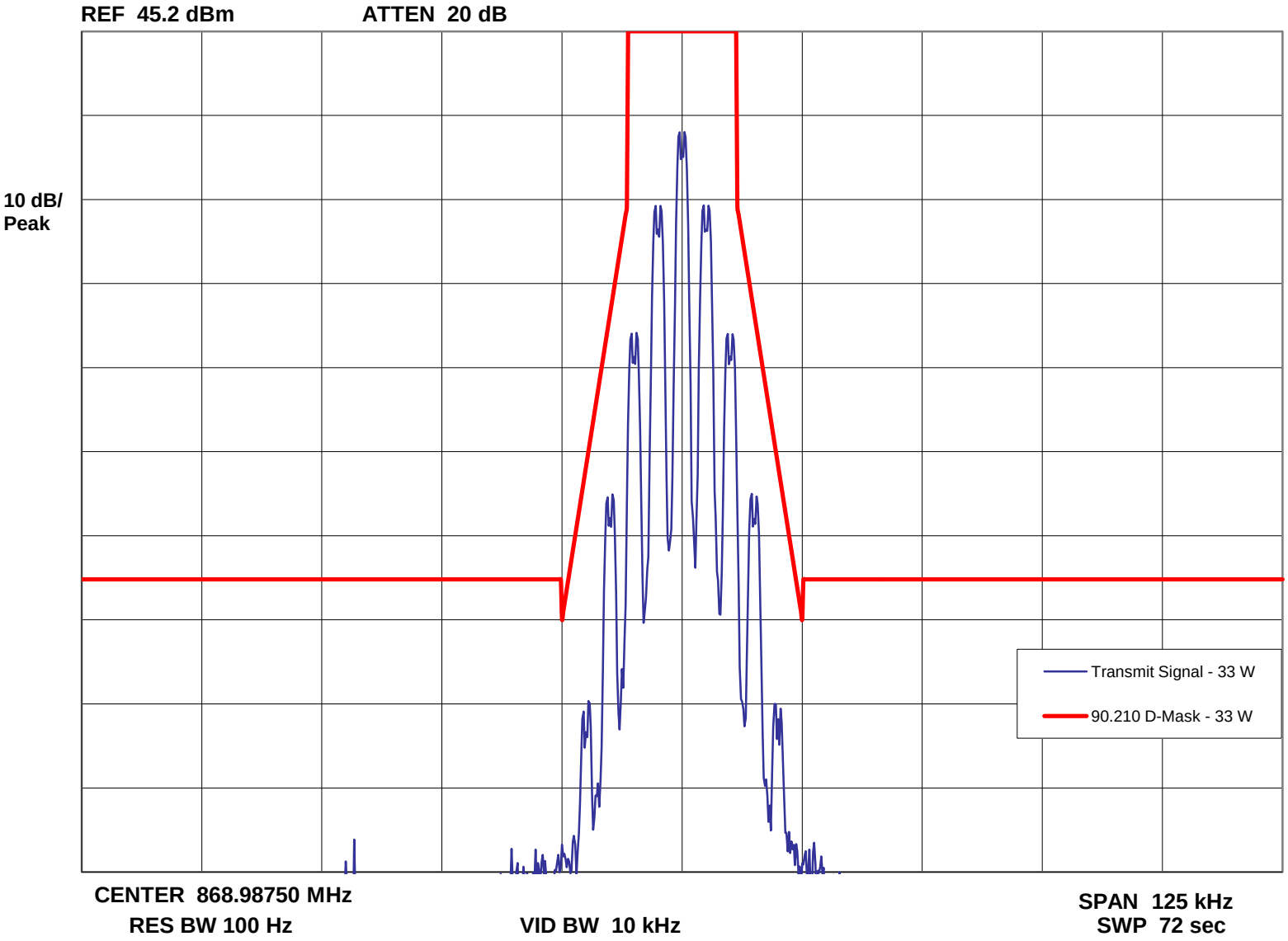
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

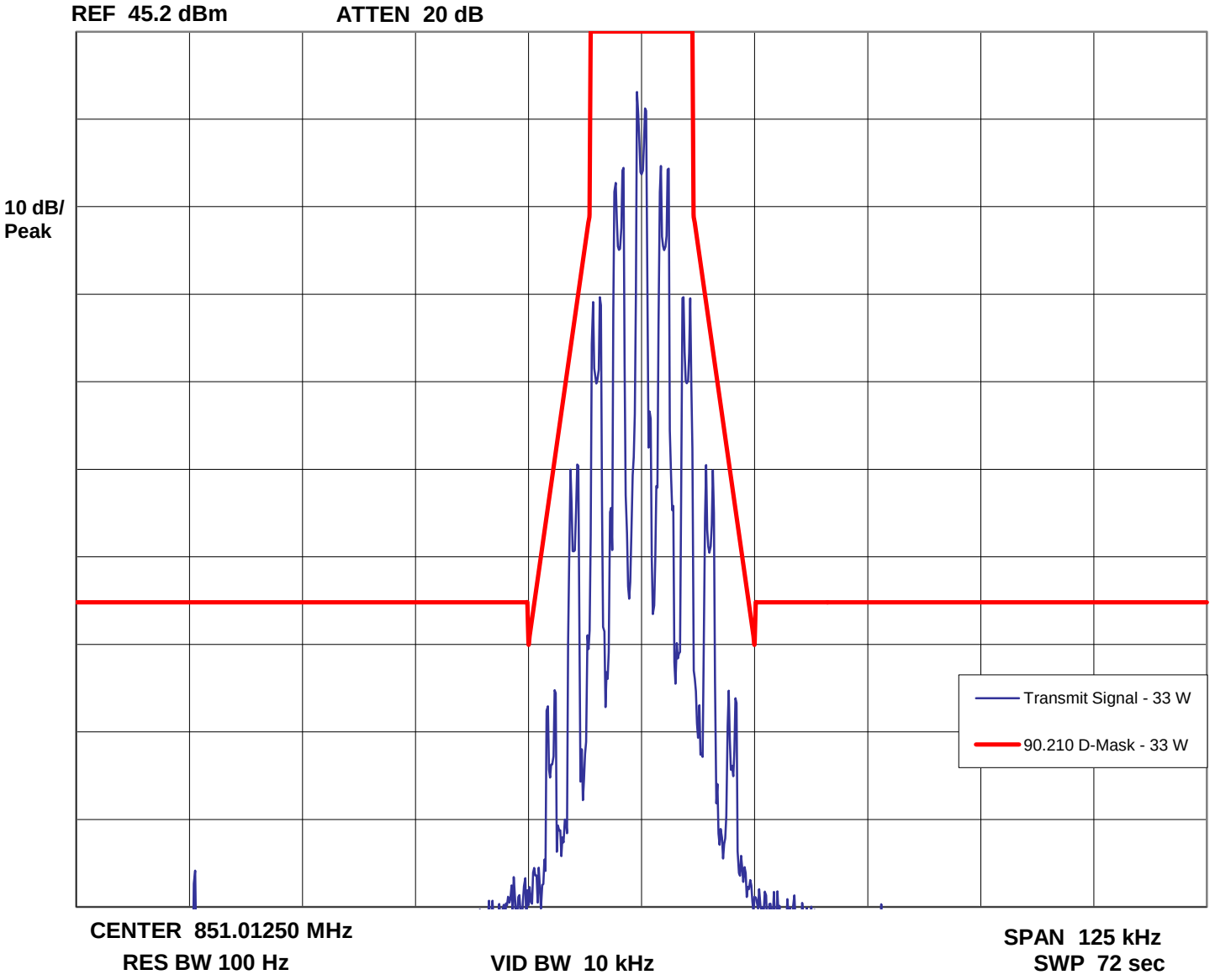
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, Digital Private Line (DPL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

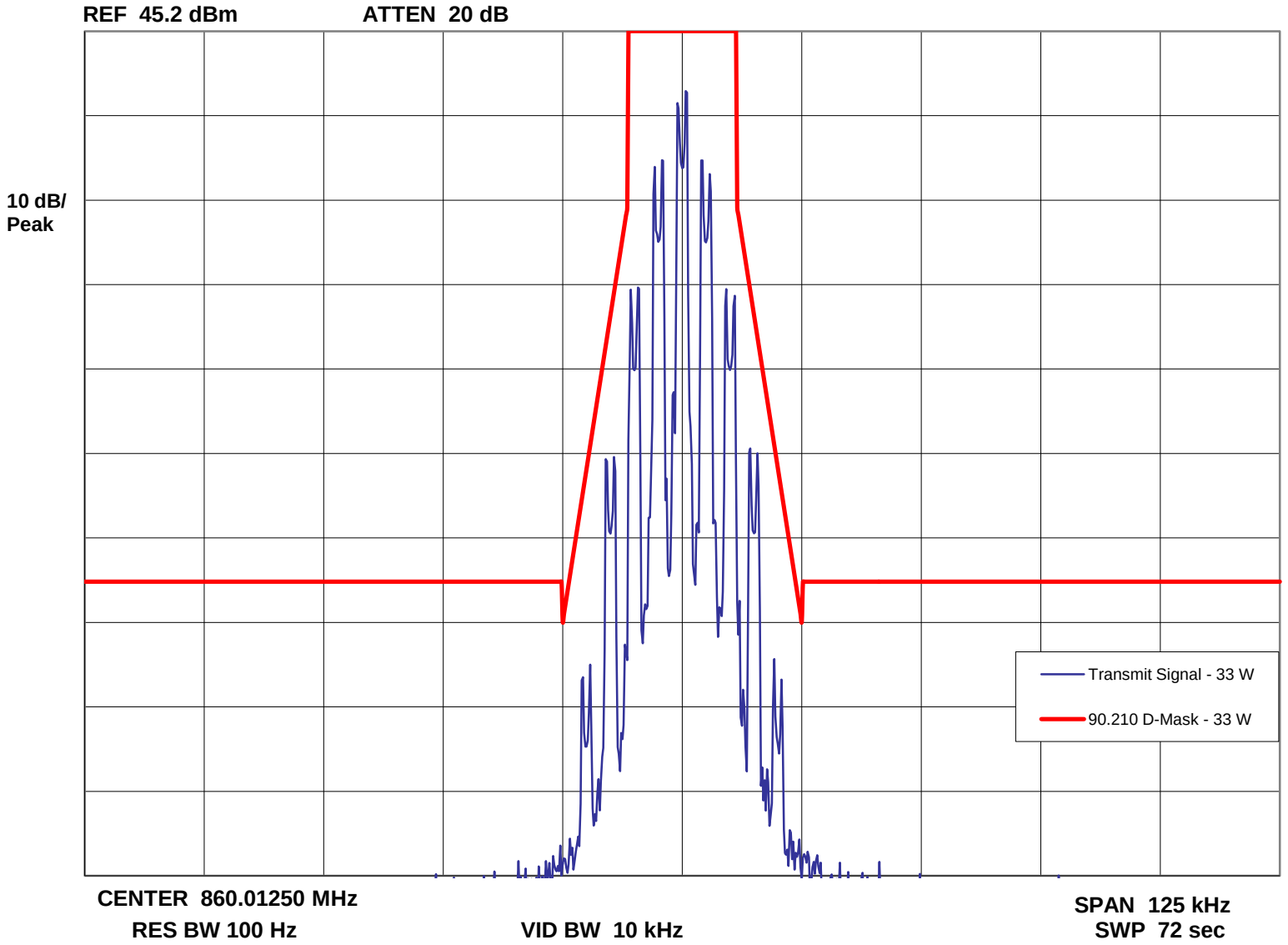
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, Digital Private Line (DPL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

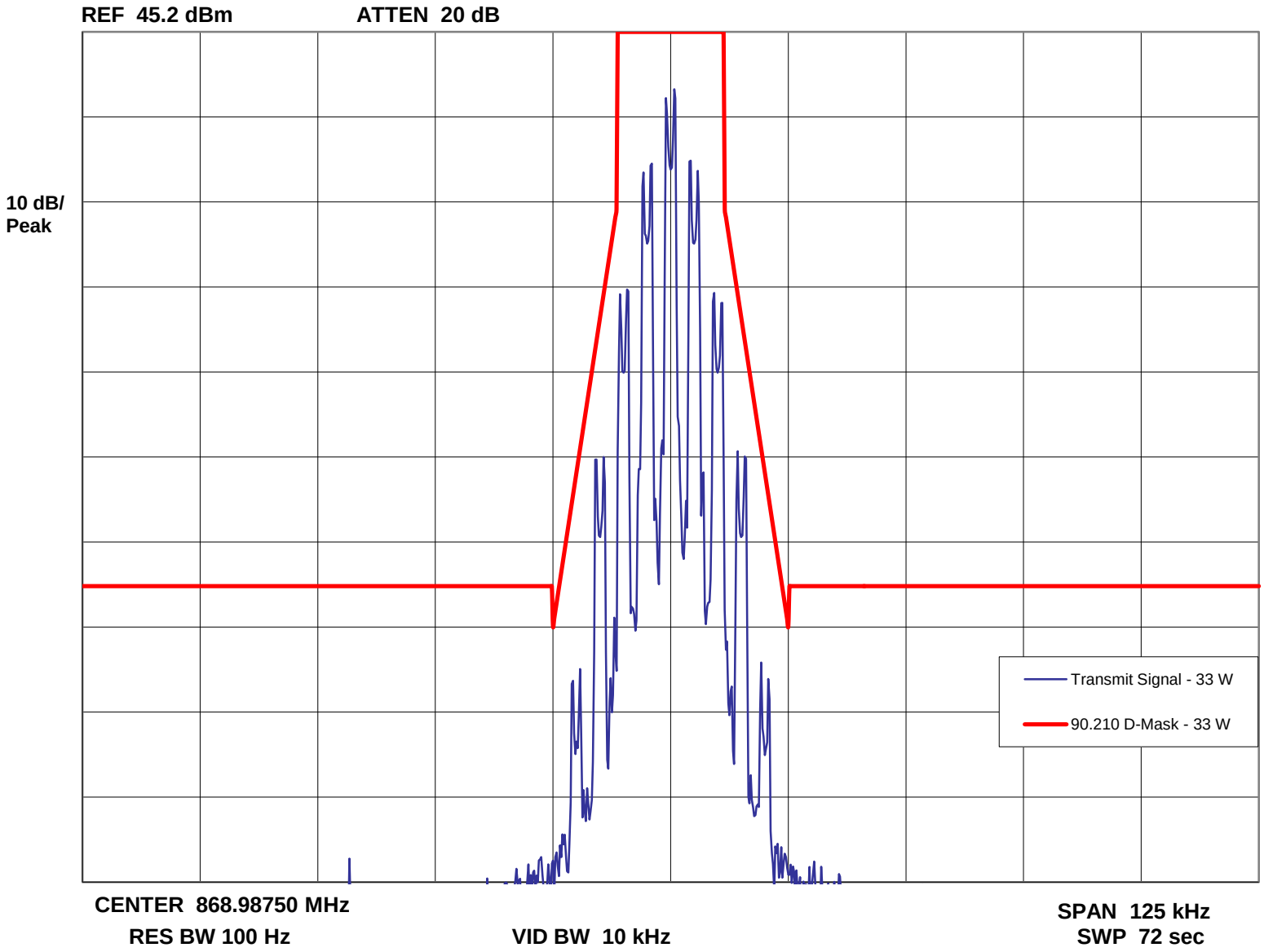
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, Digital Private Line (DPL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

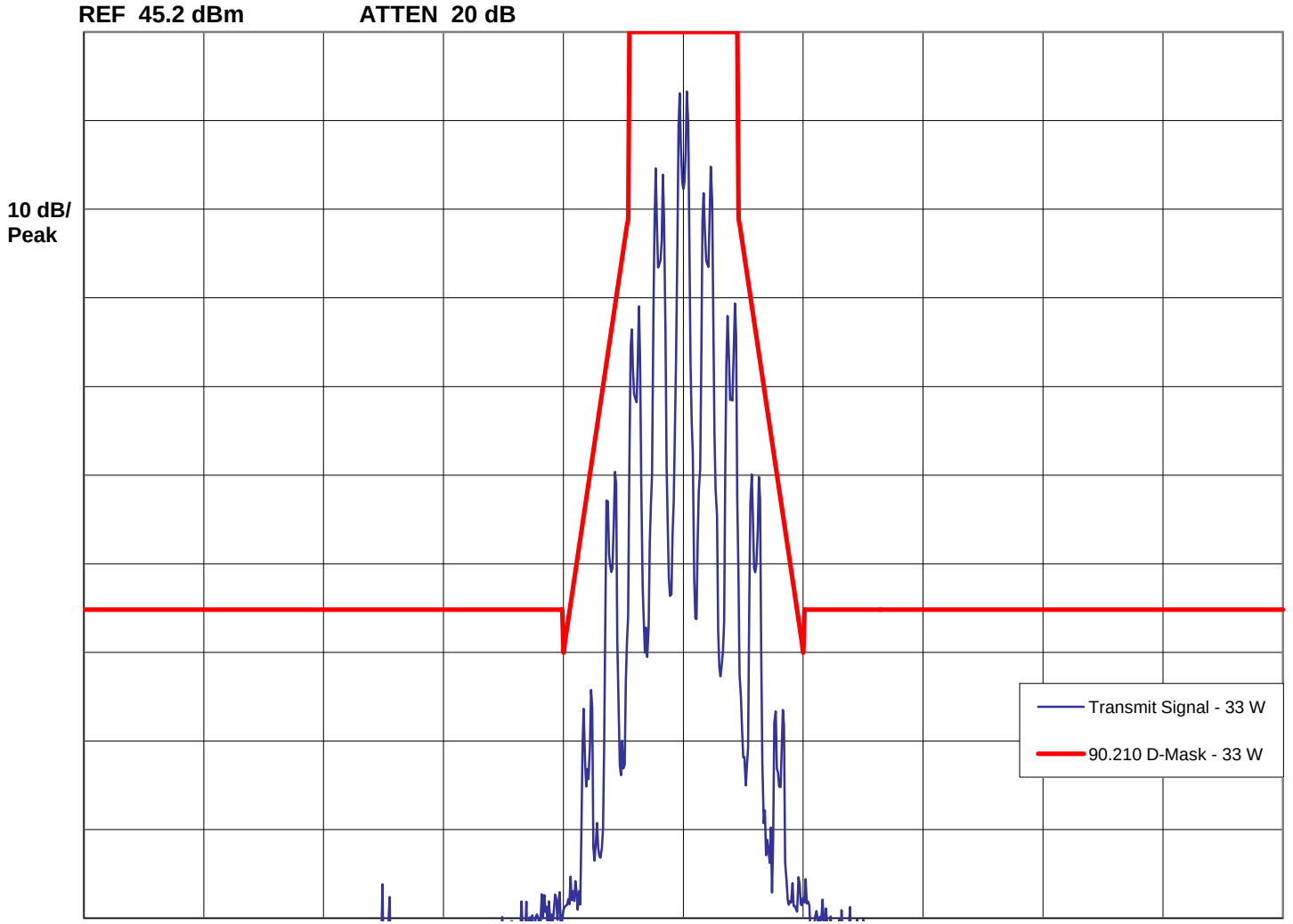
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 150 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

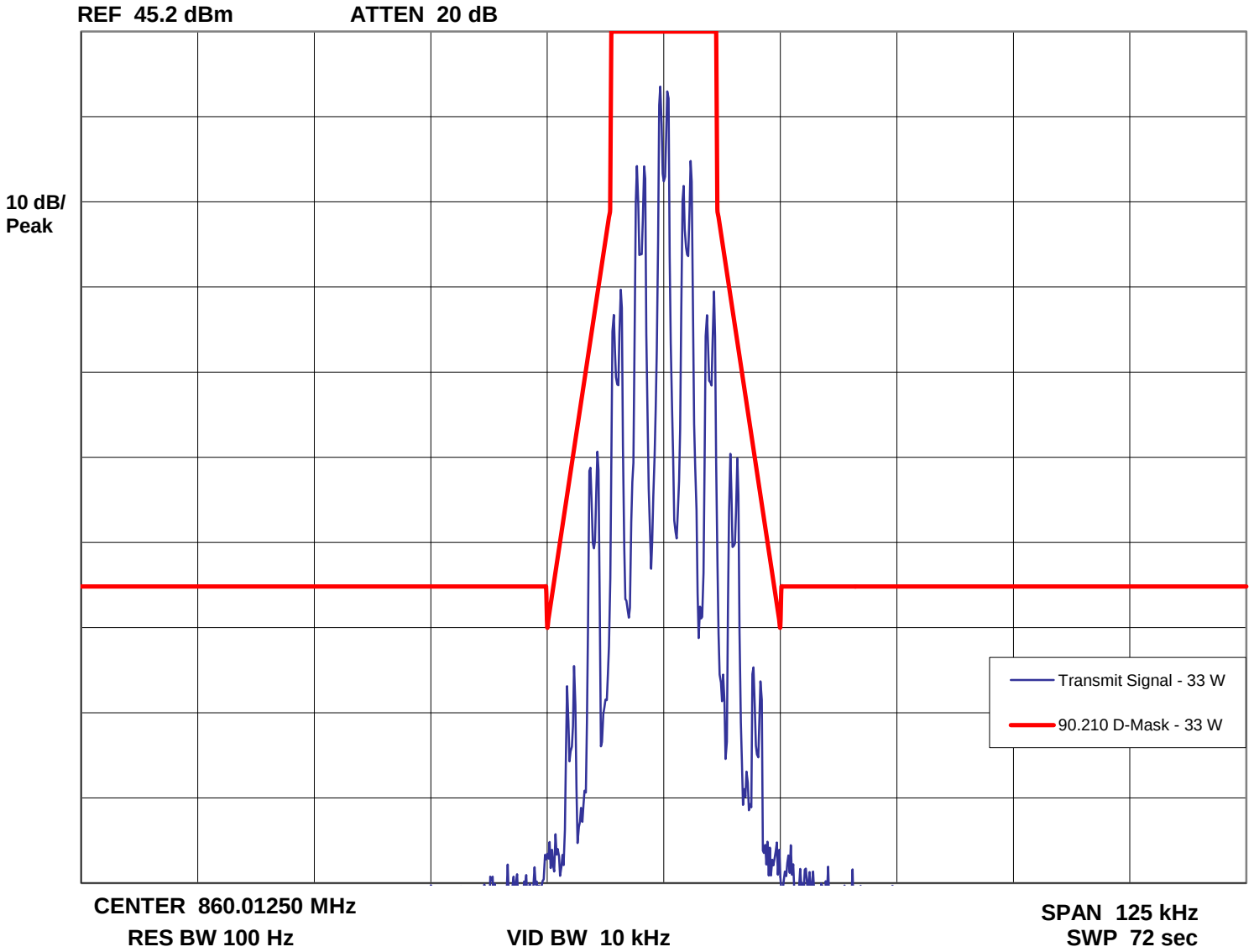
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 150bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 150 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

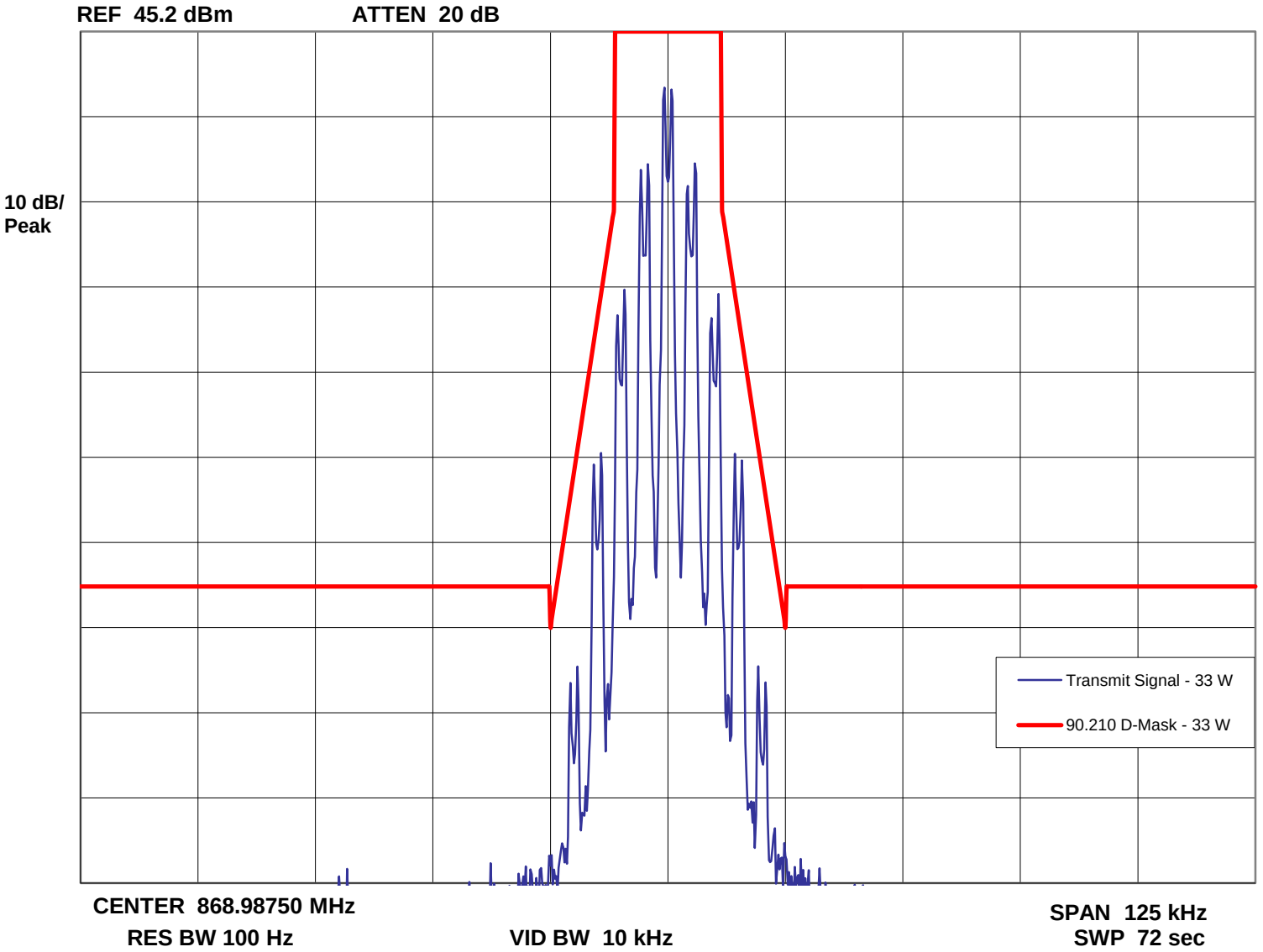
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 150 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

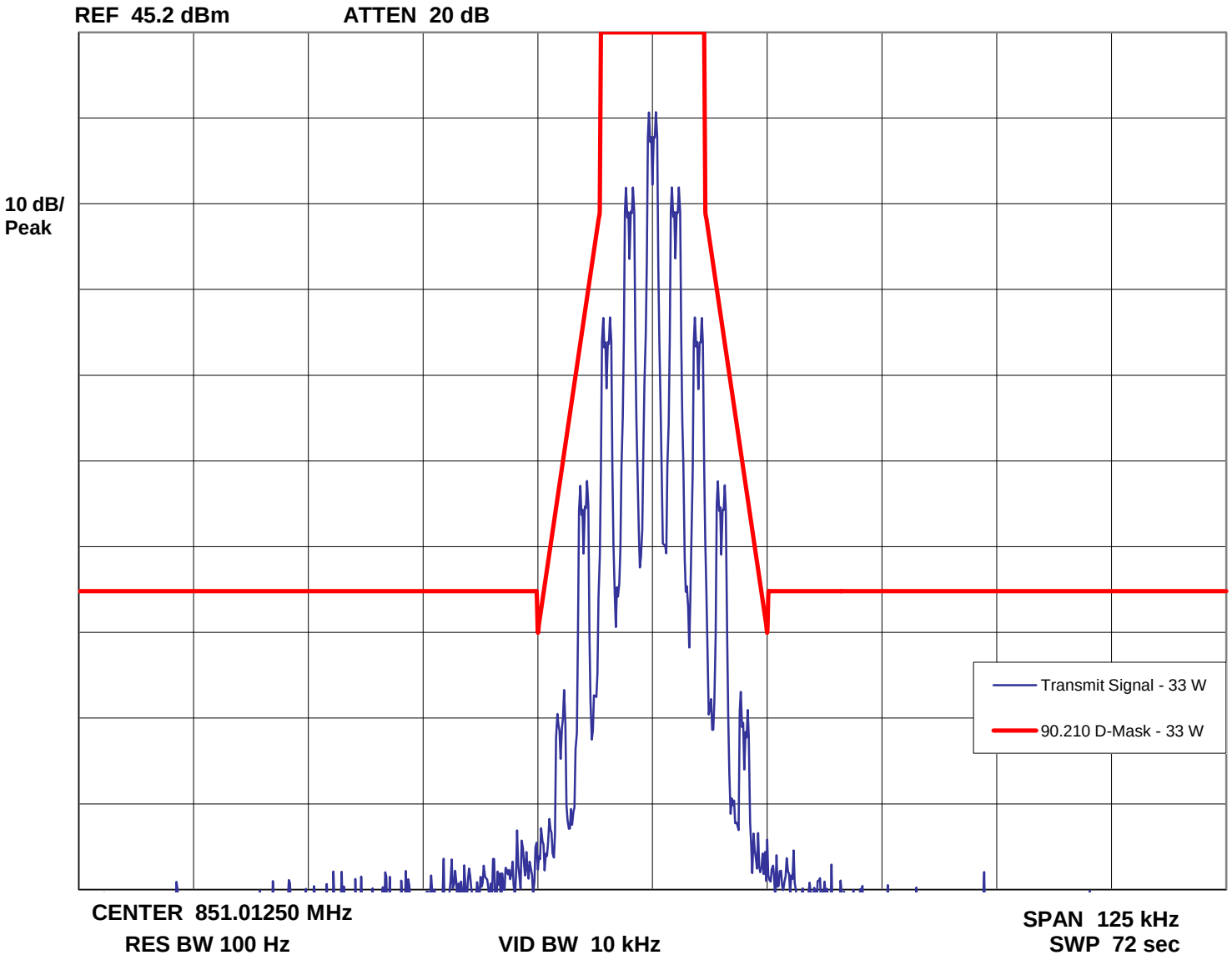
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 300 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

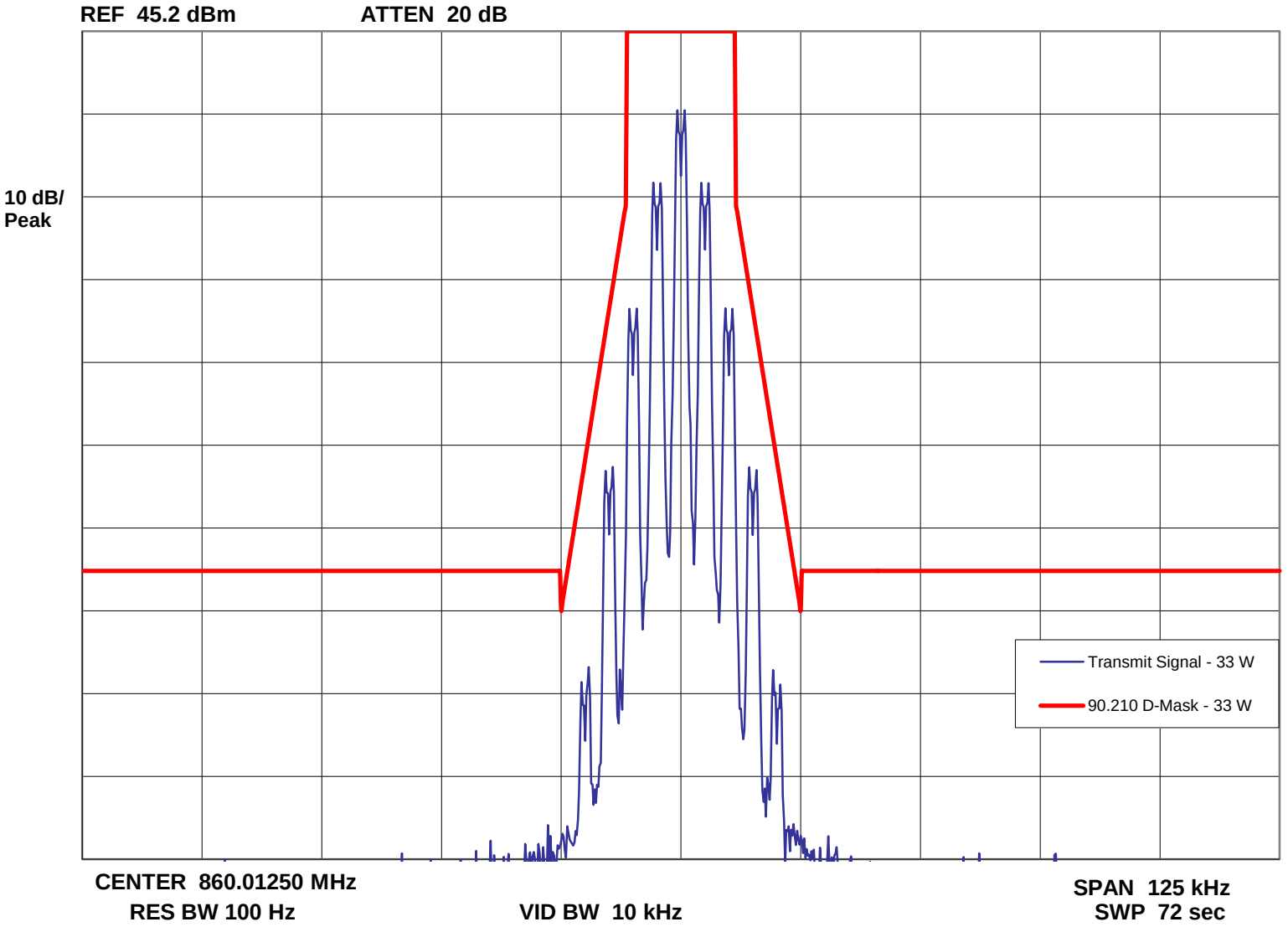
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 300 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

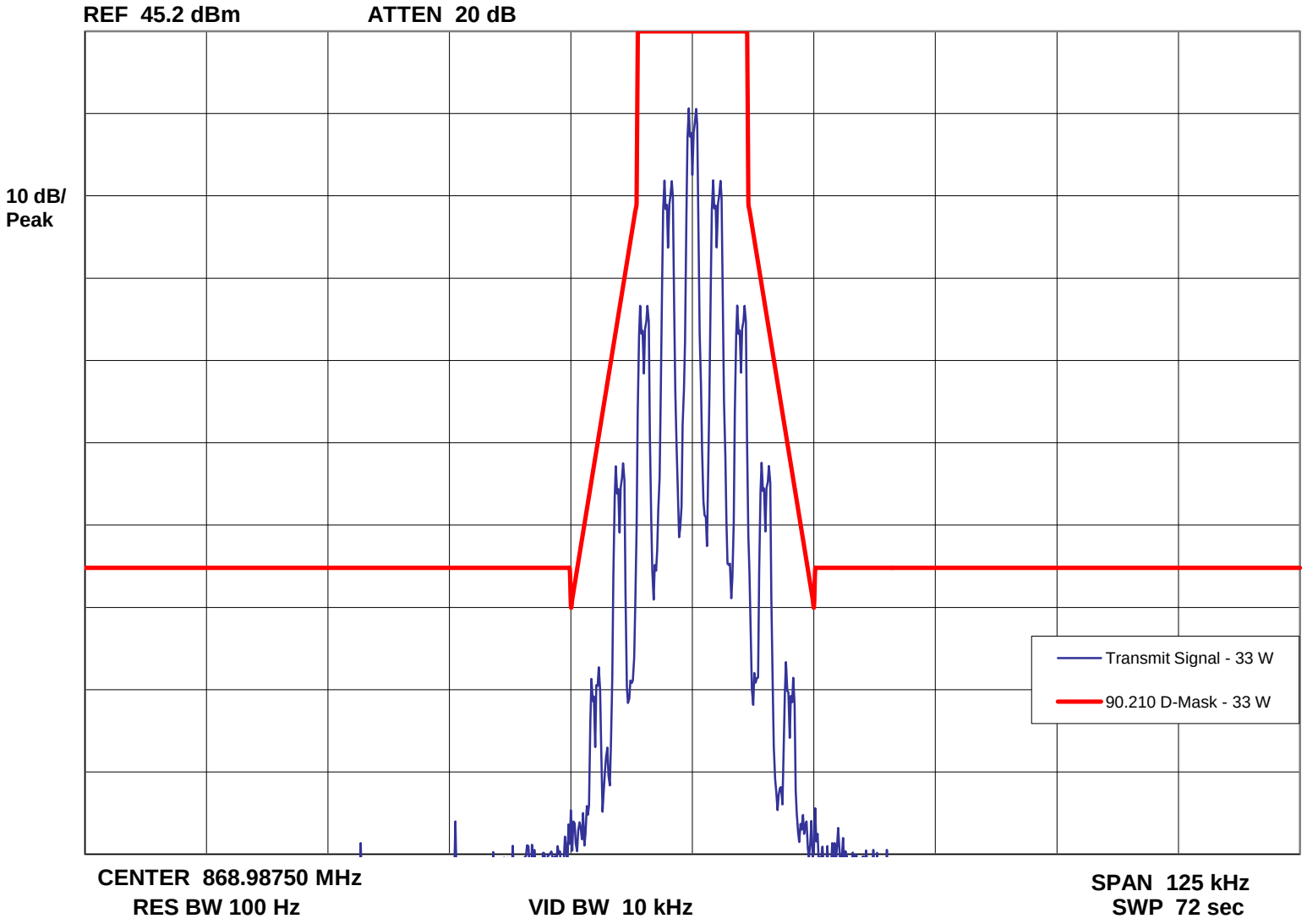
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 300 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

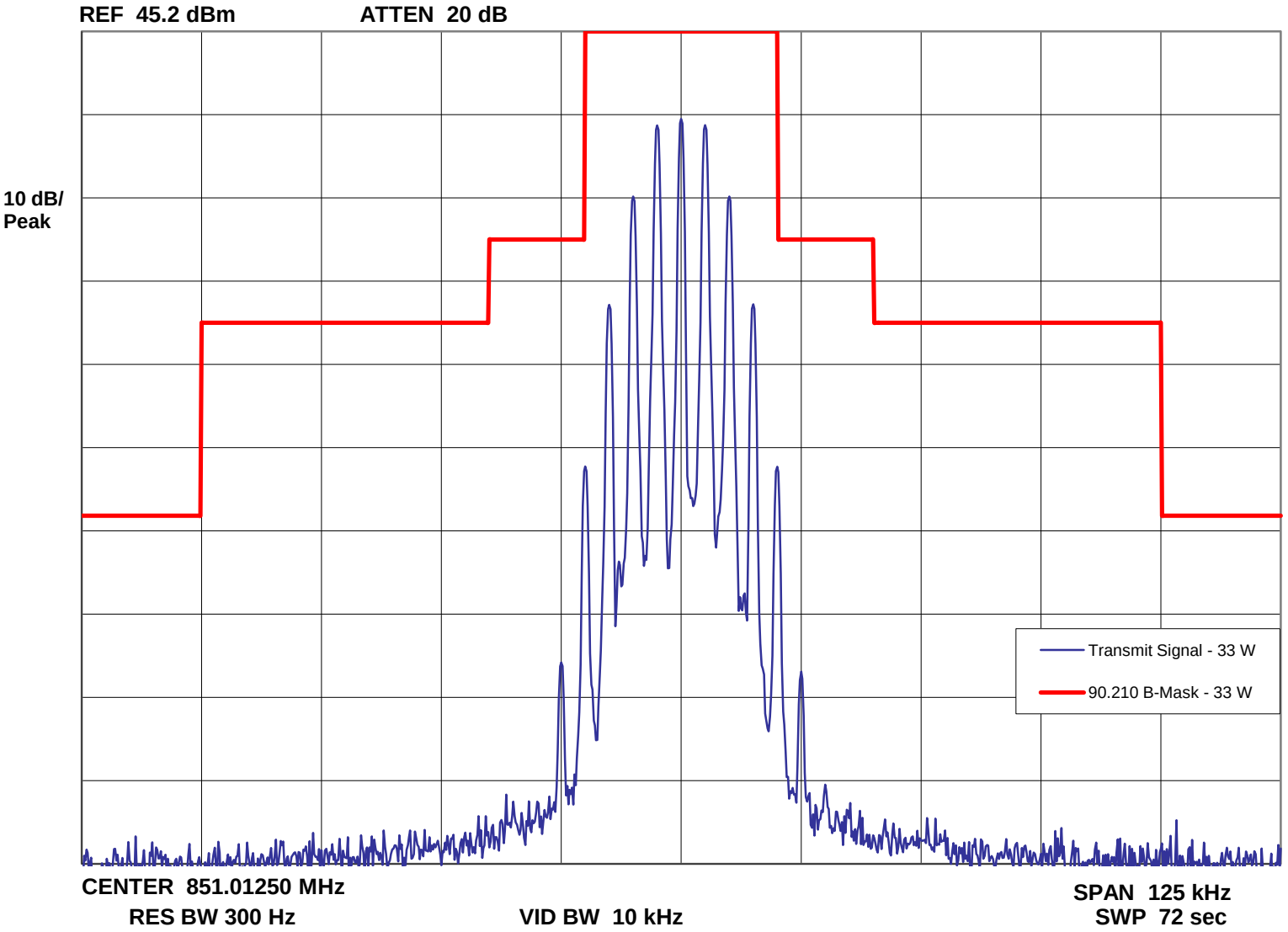
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, NPSPAC Channels – Emission Designator: 14K0F3E

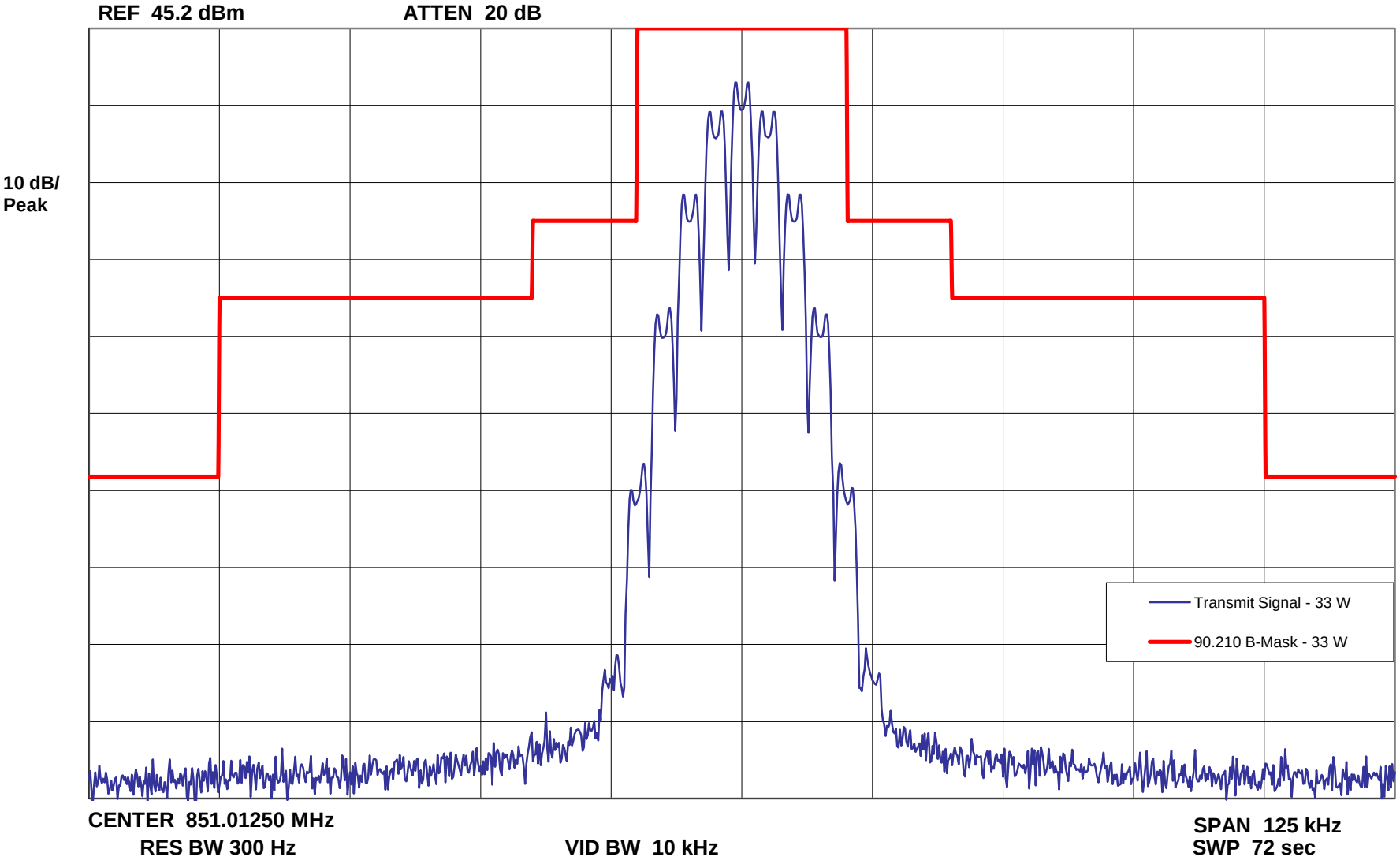
Occupied Bandwidth - NPSPAC Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, NPSPAC Channels – Emission Designator: 14K0F3E

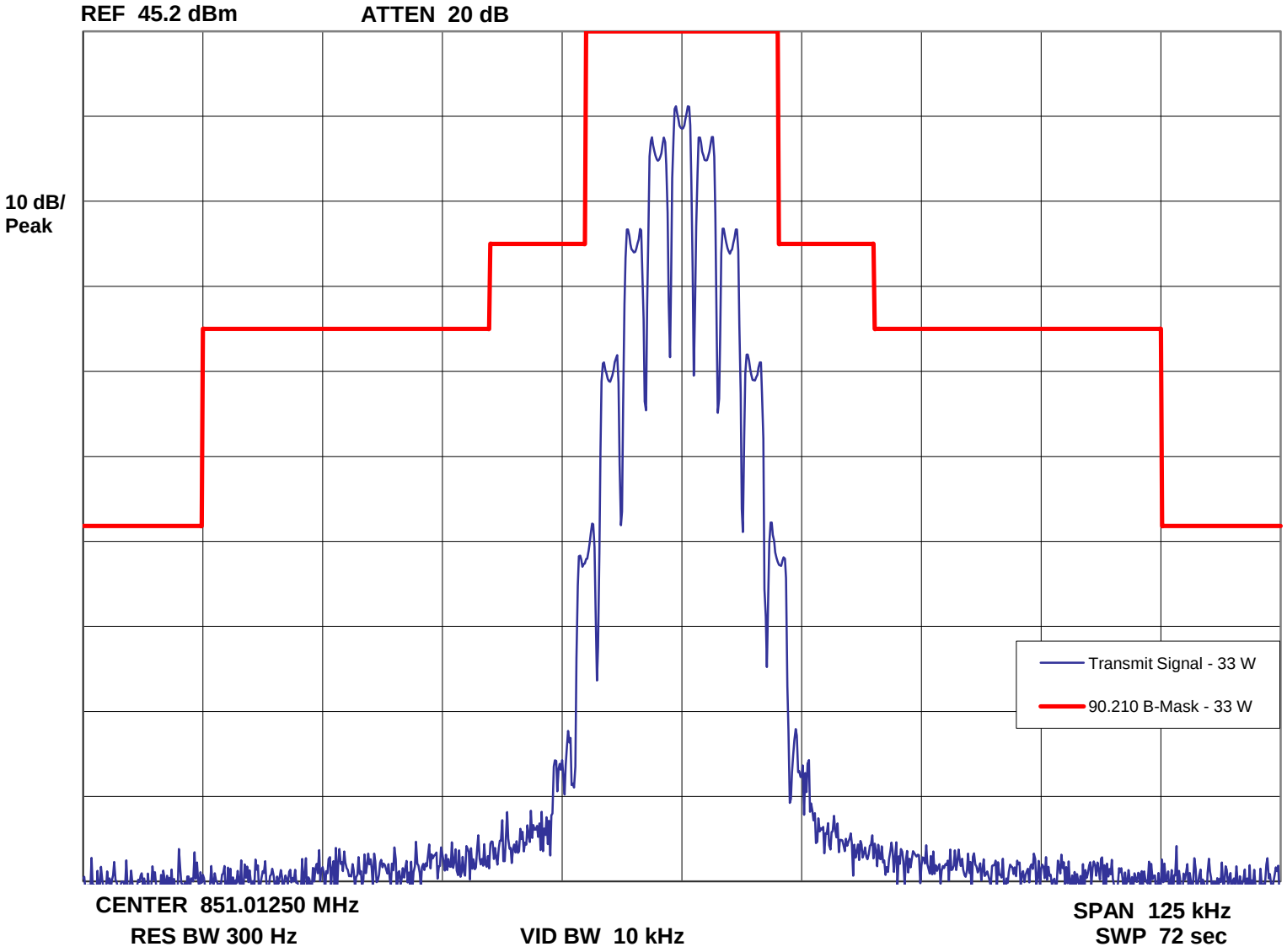
Occupied Bandwidth - NPSPAC Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Digital Private Line (DPL) Signaling, NPSPAC Channels – Emission Designator: 14K0F3E

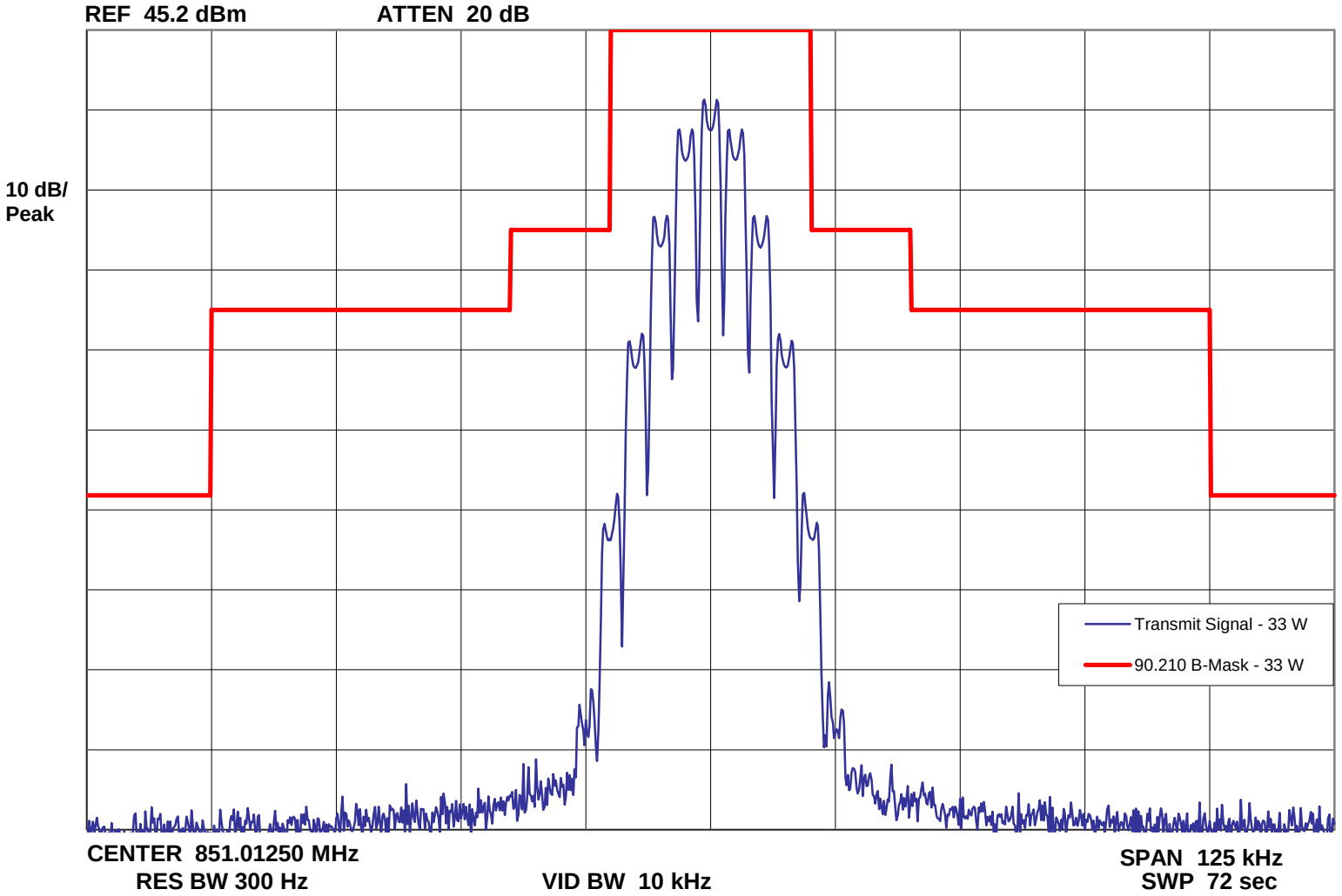
Occupied Bandwidth - NPSPAC Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and 150 bps Low Speed Data Signaling, NPSPAC Channels – Emission Designator: 14K0F3E

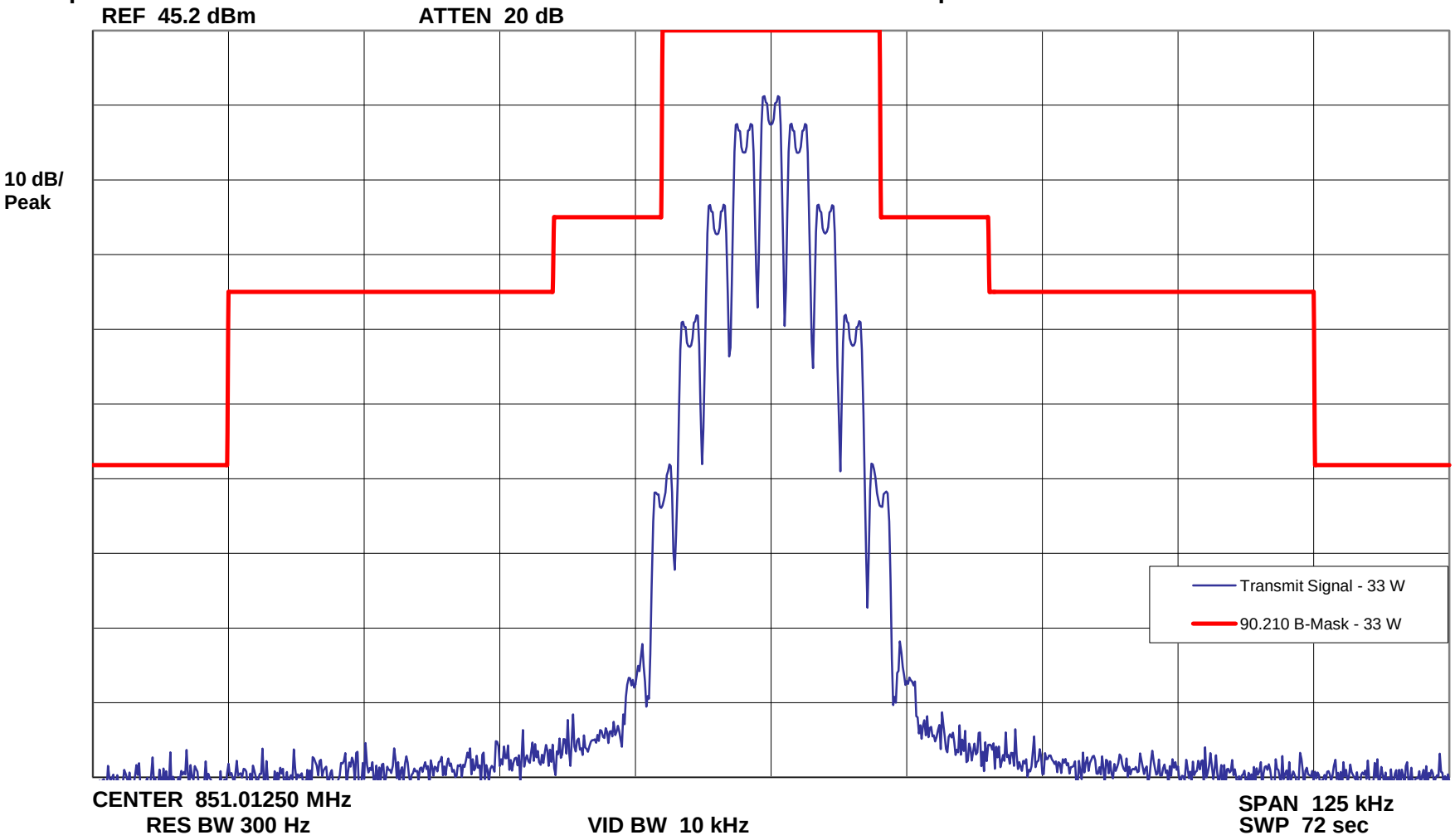
Occupied Bandwidth NPSPAC Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and 300 bps Low Speed Data Signaling, NPSPAC Channels – Emission Designator: 14K0F3E

Occupied Bandwidth - NPSPAC Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Test Equipment List

MODEL	MANUFACTURER	DESCRIPTION	Serial No.	Last Cal	Next Cal
Conducted Harmonics / Conducted Spurious Emission Spectrum					
E4440A	Agilent	Spectrum Analyzer	MY46185813	09/04/15	09/04/18
438A	Hewlett Packard	Power Meter	3048U02488	05/07/14	05/07/16
8482A	Hewlett Packard	Power Sensor	GG00004032	05/14/14	05/14/17
Frequency Stability					
N9020A	Agilent	Spectrum Analyzer	MY51110030	09/01/15	09/01/18
6032A	Hewlett Packard	DC Power Supply	US38321104	Correlated to DMM (*)	
34401A	Hewlett Packard	Digital Multimeter (*)	3146A59752	10/01/14	10/31/17
6813B	Hewlett Packard	AC Power Supply	MY41000529	Correlated to DMM (*)	
Occupied Bandwidth / Modulation Limiting / Audio Frequency Response / Frequency Transients					
N9030A	Agilent	Spertrum Analyzer	MY49432180	10/01/14	10/01/17
U8903A	Agilent	Audio Analyzer	MY49420007	09/17/14	09/17/17

Radiated and Power Supply Conducted Emissions

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
GRB0	1MHZ, LISN SIGNAL CHECKER	ELITE	LISNCHKR1M	1	1MHZ	1/28/2016	1/28/2017
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	2/25/2016	2/25/2017
GSG0	PSG ANALOG SIGNAL GENERATOR	AGILENT	E8257D	US46461202	250KHZ-50GHZ	7/29/2015	7/29/2016
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	10/27/2015	10/27/2016
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	3/2/2016	3/2/2018
PLF1	CISPR16 50UH LISN	ELITE	CISPR16/70A	001	.15-30MHz	5/20/2015	5/20/2016
PLF3	CISPR16 50UH LISN	ELITE	CISPER16/70A	003	.15-30MHz	5/20/2015	5/20/2016
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	2/22/2016	2/22/2017
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	2/22/2016	2/22/2017
RAKI	RF SECTION	HEWLETT PACKARD	85462A	3411A00181	0.009-6500MHZ	3/4/2016	3/4/2017
RAKJ	RF FILTER SECTION	HEWLETT PACKARD	85460A	3330A00154	---	3/4/2016	3/4/2017
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	2/16/2016	2/16/2017
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
WQB0	RE_8546A						
WQC0	HF_8546A						

Report on Test Measurements

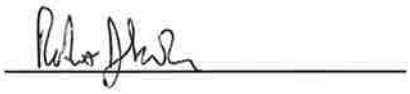
Statement of Certification

The technical data supplied with this application, having been taken under my supervision is hereby duly certified. The following is a statement of my qualifications:

College Degree: BSEE, University of Illinois, Urbana-Champaign, Illinois, USA

__30__ years of Design and Development experience in the field of two-way radio communication.

NAME: Robert Sarocka

SIGNATURE: 

DATE: June 7, 2016

POSITION: Technical Manager

I hereby certify that the above application was prepared under my direction and that to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct:

NAME: Jerry Flondro

SIGNATURE: 

DATE: June 7, 2016

POSITION: Senior Resource Manager